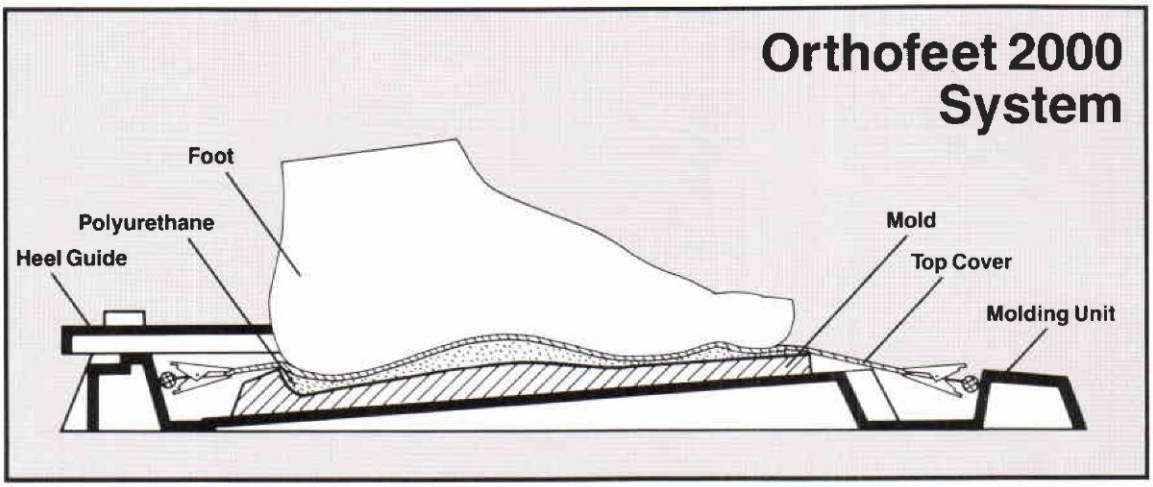
Summer 1986
Volume 40
Number 2

Orthotics and Prosthetics

Journal of the American Orthotic and Prosthetic Association

Directly Molded Orthotics ...In 15 Minutes



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Orthotics and Prosthetics

Summer 1986 **Volume 40, Number 2**

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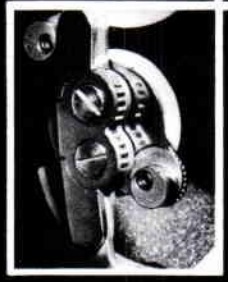

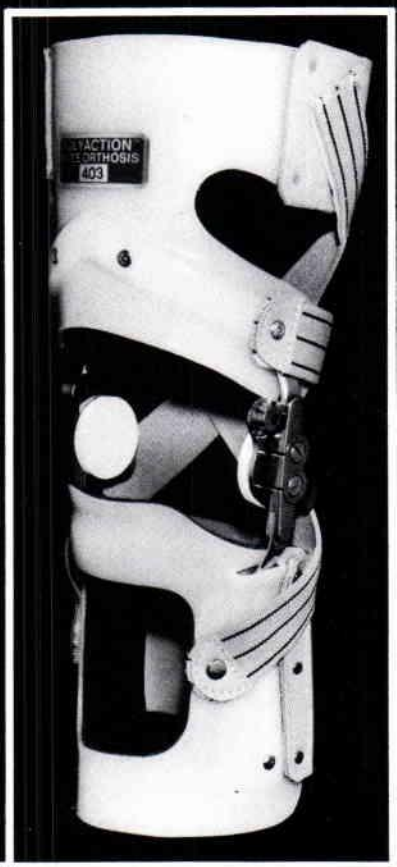

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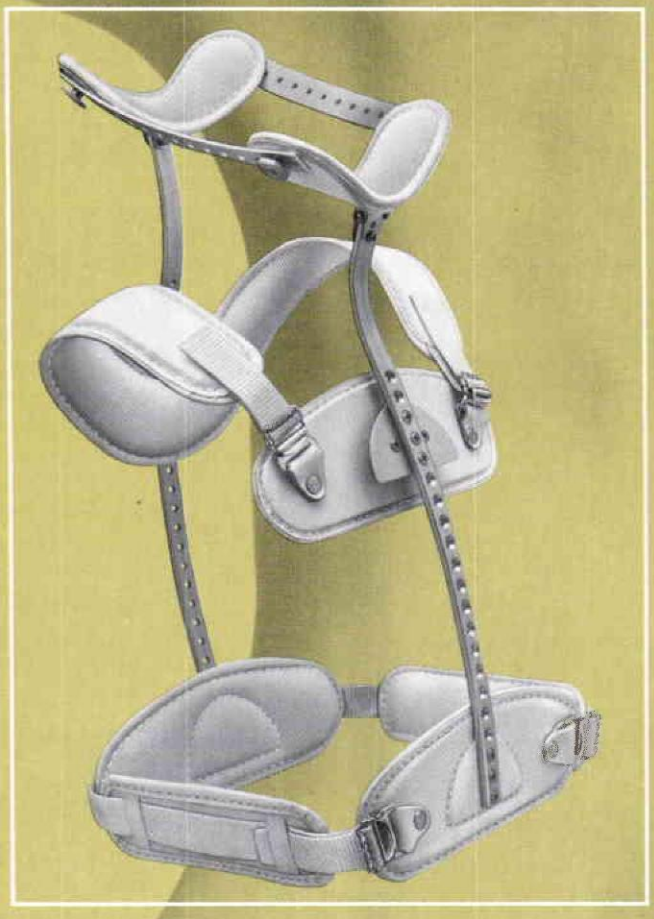

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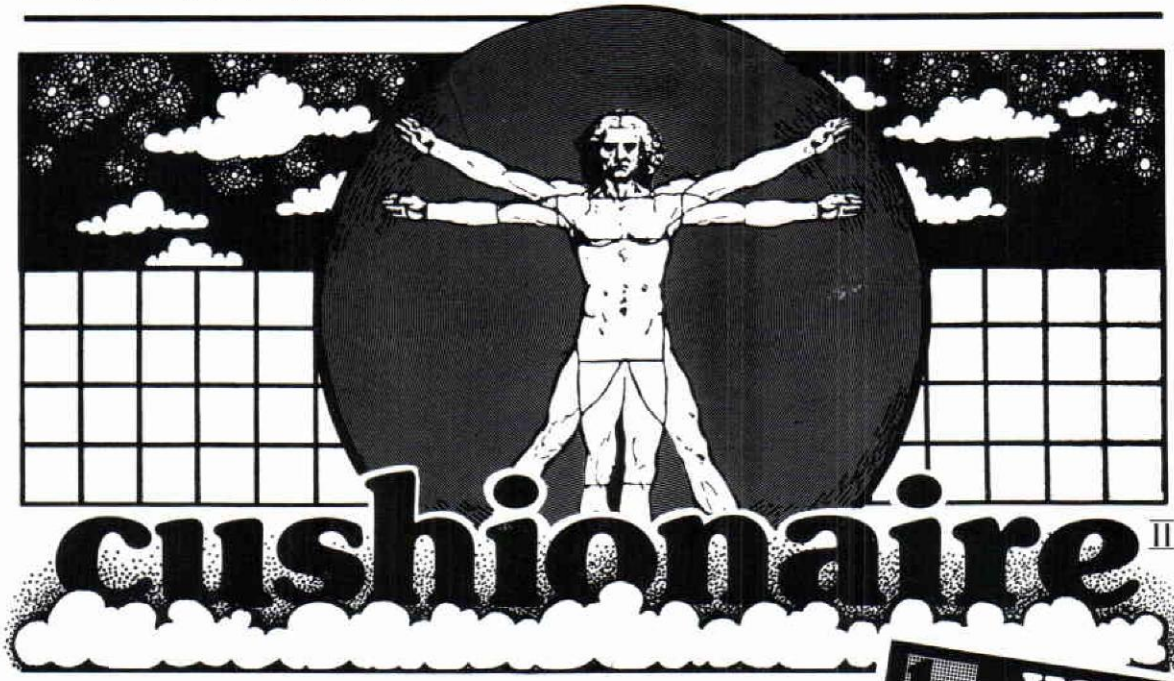

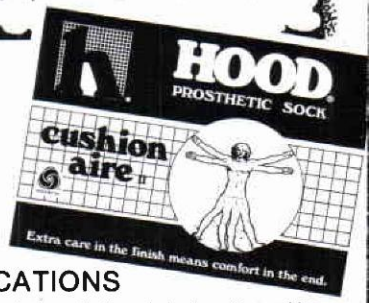

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Meetings and Events

Please notify the National Headquarters immediately concerning all meeting dates. It is important to submit meeting notices as early as possible. In the case of Regional Meetings, you must check with the National Headquarters prior to confirming date to avoid conflicts in scheduling.

1986

August 4, Canadian Chapter of ISPO Seminar, "State of the Art in Prosthetics and Orthotics," World Trade Center, Halifax, Nova Scotia, Canada. Contact: Guy Martel, Director, Prosthetics-Orthotics Department, Chedoke-McMaster Hospitals, Chedoke Hospital Division, P.O. Box 2000, Station 'A', Hamilton, Ontario L8N 3Z5 Canada; tel. (416) 521-2100, ext. 7572.

August 5–7, Canadian Association of Prosthetists and Orthotists Biennial National Convention, World Trade Centre, Halifax, Nova Scotia, Canada. Contact: Nova Scotia Rehabilitation Centre, Orthotics/Prosthetics Unit, 1341 Summer Street, Halifax, Nova Scotia B3H 4H4 Canada.

August 11–15, 1986 UNB Myoelectric Controls Course and Symposium, Fredericton, New Brunswick, Canada. Contact: Director, Bio-Engineering Institute, University of New Brunswick, Fredericton, New Brunswick E3B 5A3 Canada; tel. (506) 453-4966.

August 18–21, UCLA Total Surface Bearing Suction Below Knee Prosthetics Course, Los Angeles, California. Contact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

August 22–23, American Academy of Orthotists and Prosthetists Continuing Education Conference 4-86, "Pediatric Prosthetics," Newington, Connecticut. Contact: Academy National Headquarters, (703) 836-7118.

September 5–6, New York State Chapter of the Academy Scientific Seminar, Tarrytown Hilton, Tarrytown, New York. Contact: Martin H. Mandelbaum, CPO; (516) 744-1382.

September 9–11, "Avance Medico '86," a Medical Equipment and Materials Exhibition, United States Trade Center, Mexico City, Mexico. Contact: United States Trade Center, Liverpool 31, 06600 Mexico City, D.F., Mexico; tel. (905) 591-0155.

September 10–12, 6th Annual Advanced Course in Lower Extremity Prosthetics, East Meadow, New York. Contact: Daniel Shapiro, M.D., Department of Physical Medicine & Rehabilitation, Nassau County Medical Center, 2201 Hempstead Turnpike, East Meadow, New York 11554.

September 10–12, Hosmer Electric Systems Workshop and Seminar, Hosmer Dorrance Corporation, 561 Division Street, Campbell, California 95008. Contact: Catherine Wooten, Hosmer Dorrance Corporation, tel. 800-538-7748; (408) 379-5151.

September 12–13, Ohio Chapter of the Academy/Ohio Orthotic & Prosthetic Association Combined Fall Meeting, "Light Touch . . . Light Tech," Sheraton Columbus, Columbus, Ohio. Hosts—Mike Russell, CPO, and Bill DeToro, CO. Contact: Ohio Orthotic & Prosthetic Office, 4355 N. High Street, #208, Columbus, Ohio 43214; tel. (614) 267-1121.

September 13–16, The 39th Annual Conference on Engineering in Medicine and Biology, Omni International Hotel, Baltimore, Maryland. Contact: The Alliance for Engineering in Medicine and Biology, Suite 700, 1101 Connecticut Avenue, NW, Washington, D.C. 20036.

September 15–19, Training Course: Fitting Procedures for the Utah Artificial Arm, Newington Children's Hospital, Newington, Connecticut. Contact: Harold Sears, Ph.D., Motion Control, Inc., 95 S. Elliott Road #105, Chapel Hill, North Carolina 27514; tel. (919) 968-8492.

October 2–10, Medical, Dental, Hospital Equipment Trade Mission to England, Ireland, and Norway. Participation and information kit available from: George B. Keen, U.S. Department of Commerce, ITA Room 1015, Washington, D.C.; (202) 377-2010.

October 5–9, SaudiMedicare 86, Riyadh Exhibition Centre, Riyadh, Saudi Arabia. Contact: Peter Rosenvinge, SaudiMedicare 86, 11 Manchester Square, London W1M 5AB United Kingdom.

October 11, The Southern California Chapter of the Academy Seminar, Disneyland Hotel, Anaheim, California. Contact: Sandy Hargrave, (714) 839-9304.

October 18–20, USA Medical Advances, USA Catalog Show, Intersan Medical Fair, Milan, Italy. Contact: T.R. Jaeckle, Show Promotion Director, Export Development Office, ConGen MILAN, c/o U.S. Embassy, Rome, Italy, Box M, APO NY 09 794.

October 24–25, American Academy of Orthotists and Prosthetists Continuing Education Conference 5-86, "Spina Bifida," Cincinnati, Ohio. Contact: Academy National Headquarters, (703) 836-7118.

October 27–31, UCLA International Prosthetics Techniques Seminar, Los Angeles, California. Contact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

October 28–29, USA Medical Advances, USA Catalog/Video Show, Vienna, Austria. Contact: Kenneth D. Blum, Commercial Counselor, US & FCS Foreign Commercial Service, American Embassy, Vienna, Austria, APO NEW YORK 09108.

November 1–15, Baghdad International Fair, Baghdad, Iraq. Featuring U.S. Pavilion, now selling exhibit space to display, among other goods, equipment for rehabilitation and the disabled. Contact: Edward K. Kimmel, U.S. Department of Commerce, ITA/Rm. 4038, Washington, D.C. 20230; tel. (202) 377-3640.

November 3–7, UCLA Course, Prosthetics and Orthotics for Physicians and Allied Health Professionals, Los Angeles, California. Contact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

November 4–8, USA Medical Advances Exhibitions in Europe, in conjunction with IFAS '86, Zurich, Switzerland. Contact: U.S. & Foreign Commercial Service, Mr. D. Schaubacher, Commercial Specialist, American Embassy, P.O. Box 1065, CH-3001 Bern, Switzerland; tel. 41/31/43 73 43, Telex 912 603.

November 4–9, AOPA Annual National Assembly, Marriott's Orlando World Center, Orlando, Florida. Contact: AOPA National Headquarters, (703) 836-7116.

November 10–12, Hosmer Electric Systems Workshop and Seminar, Orlando, Florida. Contact: Catherine Wooten, Hosmer Dorrance Corporation, 561 Division Street, Campbell, California 95008; tel. 800-538-7748, (408) 379-5151.

1987

January 22–27, American Academy of Orthopaedic Surgeons Annual Meeting, San Francisco, California.

February 15–22, Academy Annual Meeting and Scientific Symposium, Hyatt Regency Tampa, Tampa, Florida. Contact: Academy National Headquarters, (703) 836-7118.

March 9–12, UCLA Total Surface Bearing Suction Below Knee Prosthetics Course, Los Angeles, California. Contact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

March 16–25, UCLA CAT-CAM/Narrow ML Above Knee Prosthetics Course, Los Angeles, California. Contact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

March 30–April 2, UCLA Total Surface Bearing Suction Below Knee Prosthetics Course, Los Angeles, California. Con-

tact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

April 2–4, AOPA Region IV Annual Meeting, Stouffer's River View Plaza, Mobile, Alabama.

April 13–22, UCLA CAT-CAM/Narrow ML Above Knee Prosthetics Course, Los Angeles, California. Contact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

May 4–13, UCLA CAT-CAM/Narrow ML Above Knee Prosthetics Course, Los Angeles, California. Contact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

May 27–30, UCLA Total Surface Bearing Suction Below Knee Posthetics Course, Los Angeles, California. Contact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

May 28–31, AOPA Region V Annual Meeting, Grand Traverse Hotel, Traverse City, Michigan.

June 5–7, AOPA Region IX, COPA, and the California Chapters of the Academy Combined Annual Meeting, Doubletree Inn, Monterey, California.

June 8–17, UCLA CAT-CAM/Narrow ML Above Knee Prosthetics Course, Los Angeles, California. Contact: Timothy B. Staats, MA, CP, UCLA POEP, Room 22-46, 1000 Veteran Avenue, Los Angeles, California 90024.

June 10–13, AOPA Regions VII, VIII, X, and XI Combined Annual Meeting, Dallas, Texas.

July 5–10, International Conference on Disability Education, Jerusalem, Israel. Contact: Israel Rehabilitation Society, 18 David Elazar Street, Tel Aviv 61901, Israel.

July 12–16, International Conference of Rehabilitation Journalists, Jerusalem, Israel. Contact: Israel Rehabilitation Society, 18 David Elazar Street, Tel Aviv 61901, Israel.

September 11–12, Ohio Orthotics and Prosthetics Association/Ohio Chapter, American Academy of Orthotists and Prosthetists combined meeting, "Bridging the Profession," Dayton, Ohio. Contact: Norma Jean Finissi, Executive Director, O.O.P.A./Ohio A.A.O.P., 4355 North High Street, #208, Columbus, Ohio 43214; tel. (614) 267-1121.

September 21–27, AOPA Annual National Assembly, Hyatt Regency Hotel, San Francisco, California. Contact: AOPA National Headquarters, (703) 836-7116.

1988

January 25–31, Academy Annual Meeting and Scientific Symposium, Newport Beach Marriott Hotel and Tennis Club, Newport Beach, California. Contact: Academy National Office, (703) 836-7118.

May 19–21, AOPA Region V Annual Meeting, Charleston, West Virginia.

June 2–4, AOPA Region IX, COPA, and the California Chapters of the Academy Combined Annual Meeting.

June 9–11, AOPA Regions II and III Combined Annual Meeting.

September 5–9, 16th World Congress of Rehabilitation International, Keio Plaza Inter-Continental Hotel, Shinjuku, Tokyo, Japan. Contact: Secretary General, 16th World Congress of Rehabilitation International, c/o the Japanese Society for Rehabilitation of the Disabled, 3-13-15, Higashi Ikebukuro, Toshima-Ku, Tokyo 170, Japan.

October 25–30, AOPA Annual National Assembly, Sheraton Washington Hotel, Washington, D.C. Contact: AOPA National Headquarters, (703) 836-7116.

1989

June 1–3, AOPA Region IX, COPA, and the California Chapters of the Academy Combined Annual Meeting.

October 2–8, AOPA Annual National Assembly, MGM Grand Hotel, Reno, Nevada. Contact: AOPA National Headquarters, (703) 836-7116.

1990

January 22–28, Academy Annual Meeting and Scientific Symposium, Hyatt Regency Hotel, Phoenix, Arizona. Contact: Academy National Office, (703) 836-7118.

June 7–9, AOPA Region IX, COPA, and the California Chapters of the Academy Combined Annual Meeting.

September 11–16, AOPA Annual National Assembly, Sheraton Boston Hotel, Boston, Massachusetts. Contact: AOPA National Headquarters, (703) 836-7116.

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Advertisers are encouraged to submit the name of a contact person within their organization for inclusion in the Ad Index.

Reprinted below is the application required by ABC for those wishing accreditation for their education programs. Please use this form when applying for credits.

American Board for Certification in Orthotics and Prosthetics

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D. Along side of, or under the presenters, his or her credentials.

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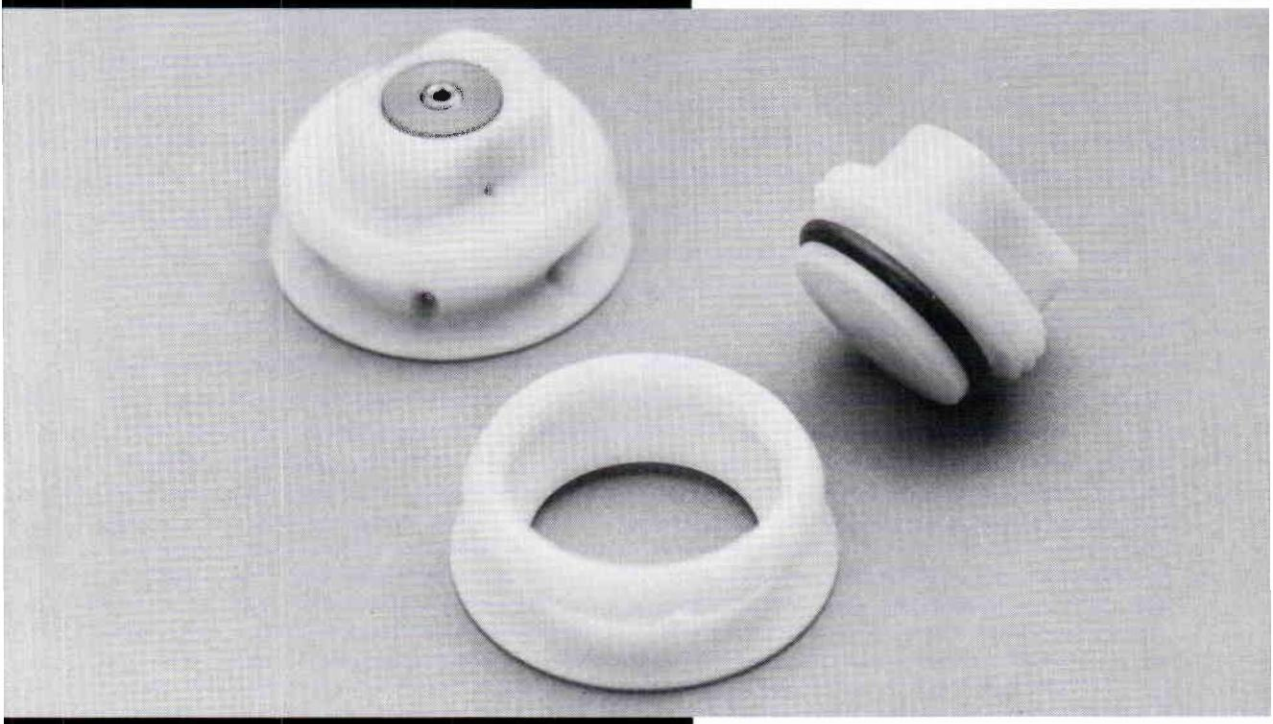

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2. BIBLIOGRAPHY. This should be arranged alphabetically and cover only references made in the body of the text.
3. LEGENDS. List all illustration legends in order, and number to agree with illustrations.
4. ILLUSTRATIONS. Provide any or all of the following:
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   b. Photocopies
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—Publication of articles does not constitute endorsement of opinions and techniques.

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—Authors will be supplied with 12 reprints.

Orthotics and Prosthetics, Vol. 40, No. 2, pp. 17–23.

Some Biomechanical Evaluations of the ISNY Flexible Above-Knee System with Quadrilateral Socket

Ichiro Kawamura
Jiro Kawamura, M.D.

INTRODUCTION

Biomechanical functions of above knee sockets can be divided into two parts. The first is to encase or contain the residual limb, and the second is to bear the weight of the amputee.

The shape of the residual limb depends on muscle activity during each gait phase. The conventional hard above knee socket cannot alter itself with these changes. If we use a flexible socket to encase the changing limb, which is held by a hard weight bearing frame, the amputee should feel more comfortable in this socket (Figure 1), also the fit of a suction socket will be more complete in it. So it can be assumed that the ISNY (Icelandic-Swedish-New York) socket has been developed in this context.

Over 70 prostheses incorporating the ISNY flexible above knee socket have been fabricated in our facility. The patients' subjective evaluations to the sockets are very good. In this study, we have attempted to evaluate and study biomechanically three above knee amputees (Table 1) with regards to the socket shape and degrees of adduction of the femur.

METHOD

Using three linear motion transducers (potentiometer), we have measured the movement of the socket walls. Three transducers were attached to the central point of the socket walls at right angles to the anterior, lateral, and posterior sides (Figures 2, 3, and 4). The data gained from the transducers were recorded by a data-corder, transmitted to an A/D converter, processed by micro-computer, and drawn on sheet paper automatically by the X-Y plotter. Using foot switches which are attached to the prosthetic and normal shoe soles, we recorded the stance-phase of each leg with time. The system is shown in Figure 5. Measurements were made for a ten meter walk, which was repeated five times (Figure 6).

Results of our study, which showed changes of the socket shapes measured by the linear motion transducers, were almost the same for the three amputees, so we have displayed only the result of subject H (Figure 7).

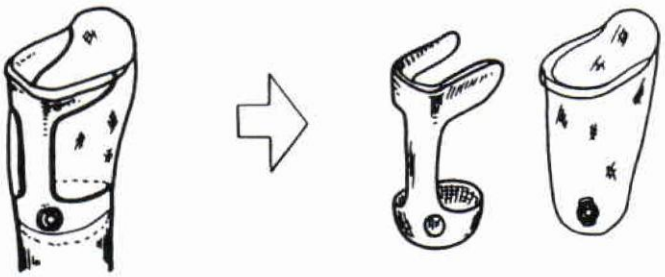
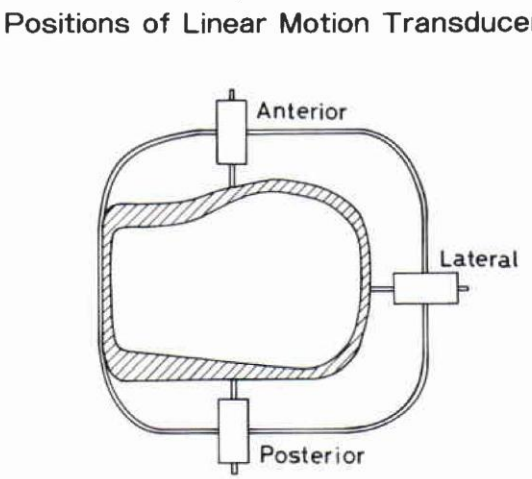


Figure 1. (left) Components of the ISNY Flexible Socket System, including completed system, rigid frame, flexible socket.

Figure 2. (below) Cross-sectional view showing initial position of transducers on anterior, lateral, and posterior walls.



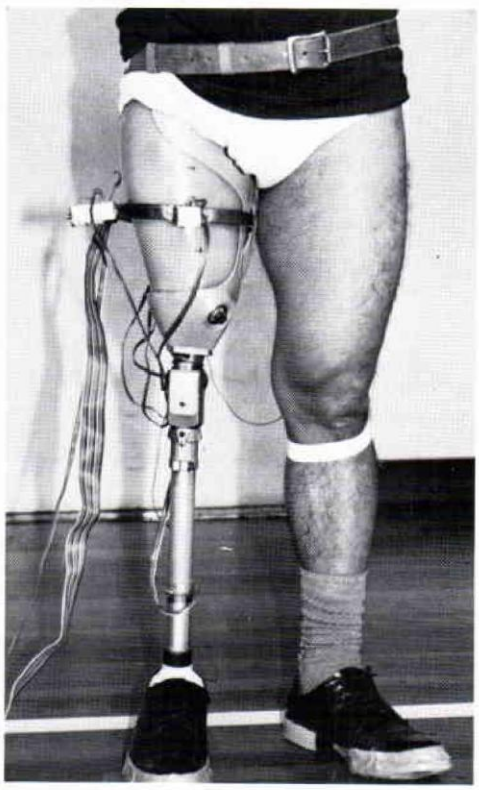


Figure 3. Anterior view of flexible socket on patient.

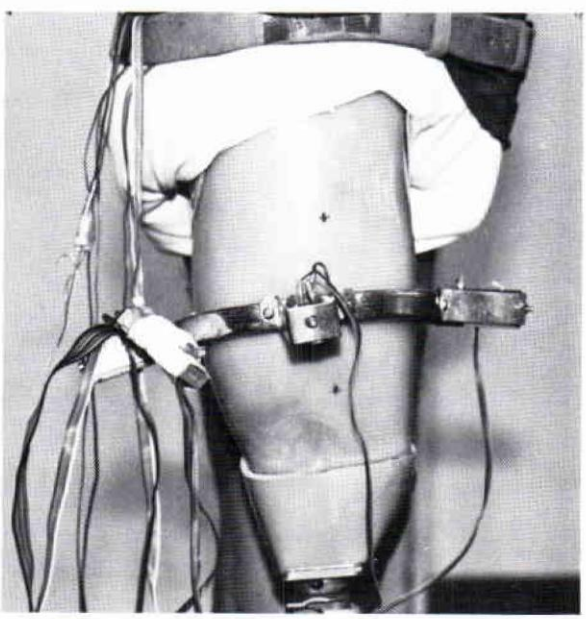


Figure 4. Lateral view of flexible socket on patient.

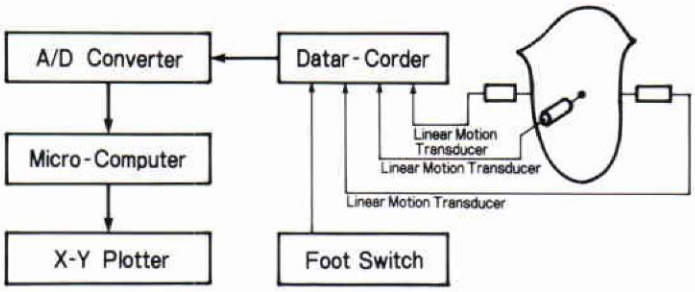


Figure 5. (left) Schematic illustrating recording system for socket data.

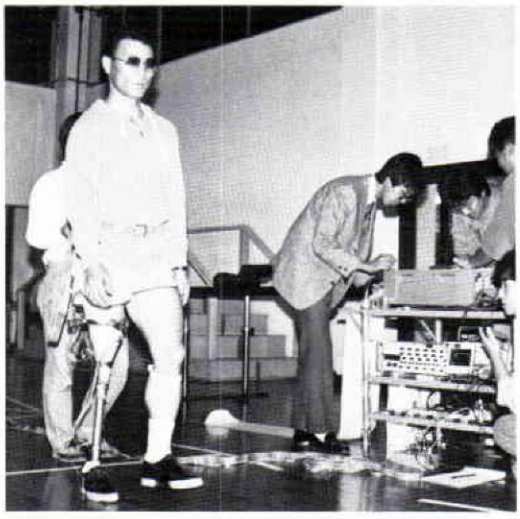


Figure 6. A demonstration of the study in progress.

Subject	Length of Stump	Age	Years after Amputation
T	14 cm	36	20
H	23.5cm	36	24
S	25 cm	39	21

Table 1. Statistics of the three amputees in the study.

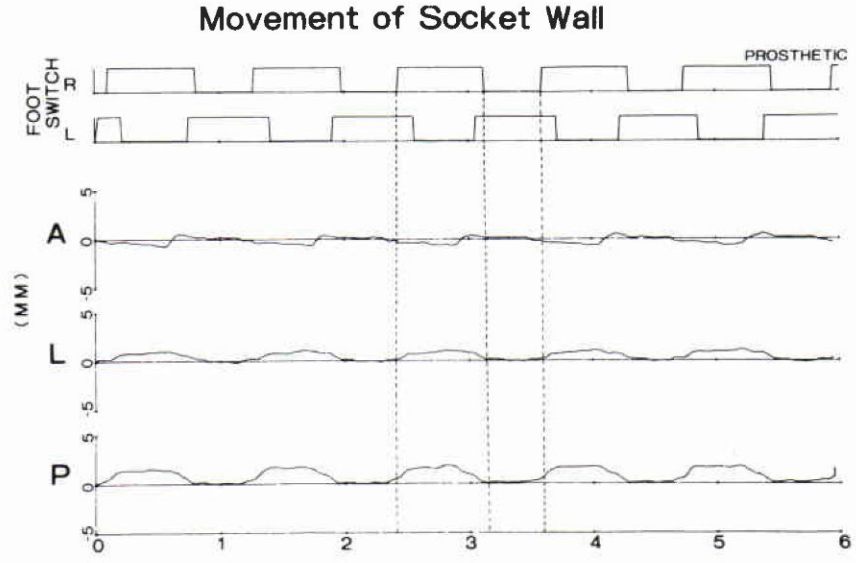


Figure 7. Graph of data plotting millimeters of motion (Y) vs. time (X).

RESULTS

The upper position of Figure 7 shows which side is in the stance phase, and the lower position shows changes of the socket walls—anterior, lateral, and posterior—corresponding to the walking cycle.

The vertical axis shows deviation expressed in millimeters. The positive direction shows expansion of socket, and negative direction shows shrinkage. The horizontal line shows time in seconds; in this case, the anterior wall shrinks from the beginning of stance phase and continues to the push off phase of stance. This subsequently reverses to expansion before gradually returning to a neutral position. From the middle of swing phase, to near the start of stance phase, the lateral and posterior walls expand. There is a gradual decrease from push off and a return to neutral position at the beginning of swing phase.

The mentioned results are illustrated in Figure 8; broken lines show the socket of the prosthesis in a relaxed state. The solid lines indicate the prosthetic socket shapes at various points during gait. At heel contact, the socket anterior wall collapses and the posterior wall expands. At mid-stance, the lateral wall expands, while at push-off the anterior wall expands and the previously expanded posterior wall reduces. At toe-off, the socket shape returns to a relaxed position.

These findings explain the change in socket shape. At heel contact, the posterior residual limb musculature expands; at mid-stance, the femur pushes the socket wall outward to hold the pelvis in a horizontal position; and at push-off, the anterior musculature expands to swing the leg forward, all of which corresponds to our expectations.

The amount of deviation related to the movements of the socket walls was not so great. In this case, the maximum deviation was 1.6mm, but for the other subjects the maximums were 5.0mm.

Femoral Adduction

The degree of adduction of the femur in the flexible socket might be supposed to be much smaller, so we inspected this by x-ray. We found that there is no difference between a flexible socket and a hard socket concerning the degree of adduction of the femur (Figures 9 and 10). The flexible sockets were, of course, duplicates of the hard sockets.

At this point, it seemed necessary to take the whole lateral wall movement, and measure it more precisely. To do this, we attached four transducers onto the lateral wall, from the proximal area to the distal (Figure 11). The movement of the lateral wall at each point was recorded automatically, by the same measuring system, and the result is shown in Figure 12. We as-

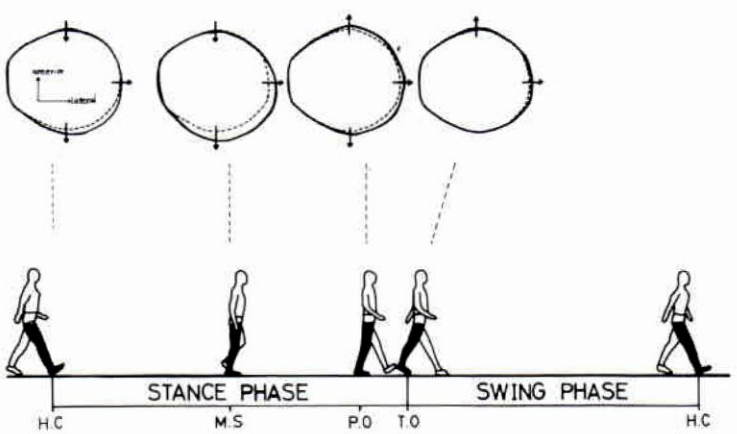


Figure 8. (left) Graphic representation of the data with phase of gait during which it is observed."

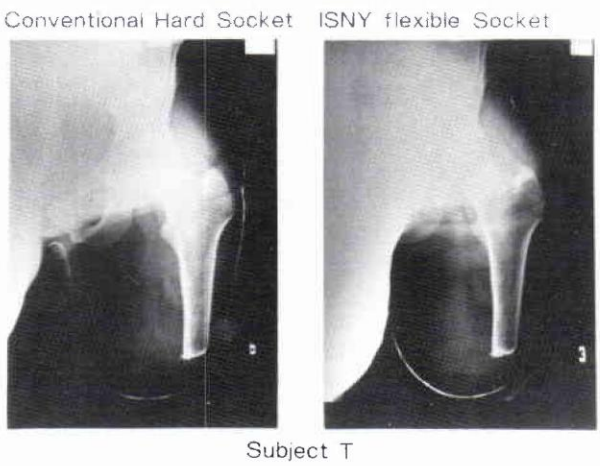
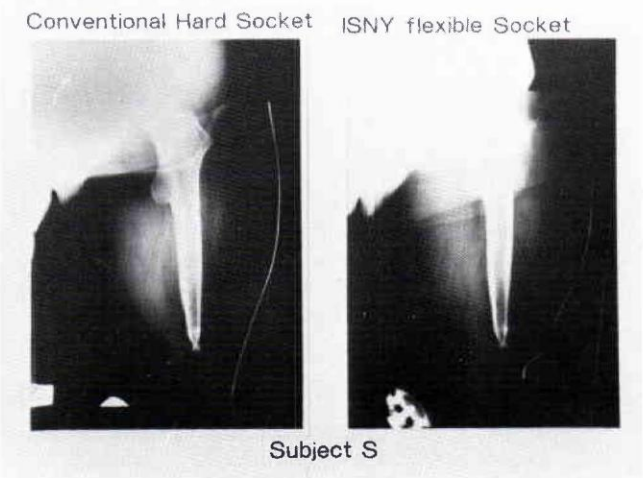


Figure 9. (left) Adduction angle of femur in subject T.

Figure 10. (right) Adduction angle of femur in subject S.



sumed that the largest expansion of the lateral wall can be seen at the lowest point at the stance phase. The level arm of the femur will push at this point toward the outside direction the strongest. But, as you see in Figure 12, the biggest deviation is seen in the proximal second point. At heel contact, the lateral wall expands rapidly and continues expanding until push off, where it gets its maximum deviation (in this case five millimeters). The socket wall then shrinks rapidly until toe off, where it returns to a zero level. The expanding of the most distal point is not so large as compared with the proximal second point. It expands also in the stance phase, but the maximum deviation is about three millimeters.

Contrarily, we can see the largest collapse in this distal point during the swing phase. The wall collapse starts just after toe off and gradually gets larger near the end of swing phase. It then returns to zero at heel contact of the prosthetic side.

We can see some shrinkage of the lateral wall at the most proximal point, but in this case, the pattern of movement is a little different compared with the most distal point. In the proximal point, the shrinkage starts at mid-swing phase, gets largest around heel contact of the prosthetic side and continues to midstance, where it re-

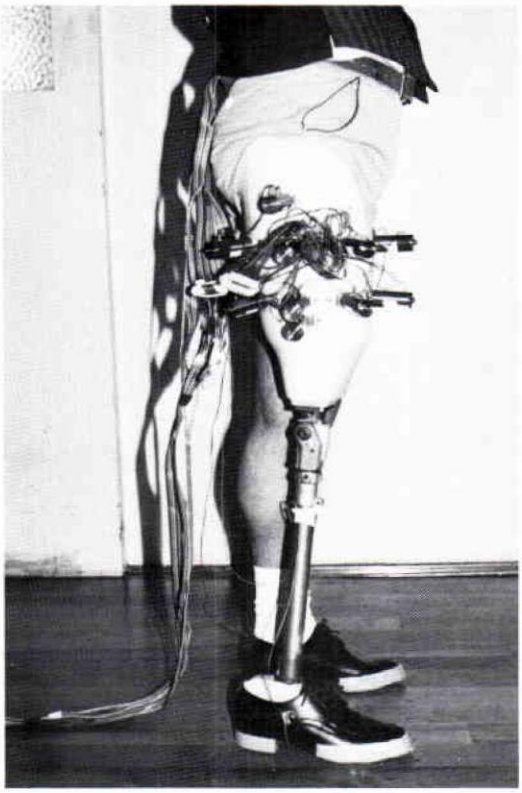


Figure 11. Lateral view, showing socket with four transducers placed along lateral wall.

turns to zero. From these results, it can be concluded that the lateral wall of the ISNY flexible socket has sufficient strength to hold the femur in the initial adducted position. In addition, the lateral wall movements of the flexible socket correspond to the changes in the residual limb's soft tissue shape. If the socket wall movements were caused by the lever arm movement of the femur, our result would be completely different.

Socket Wall Thickness

The socket wall thicknesses seem to be unequal for each area. This is caused by the manufacturing procedures. We cannot overlook this fact when speaking about the socket wall movements. We have measured the thickness of the flexible socket using a micrometer for 29 points. That corresponds to four different height levels, each eight points from medial, anterior, lateral, and posterior. We used three positive models and we made three sockets for each model. The material used is four millimeter polyethylene, which is vacuum-formed by a standard method. The results of these nine sockets were not much different, and a case is demonstrated in Figure 13. The numbers

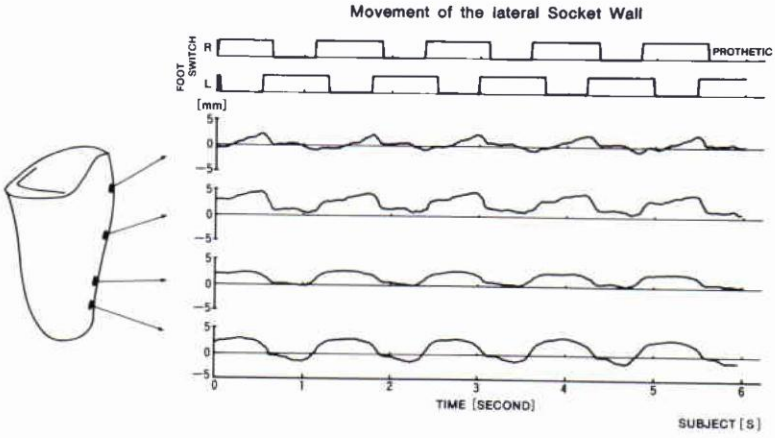


Figure 12. Motion of lateral wall during gait.

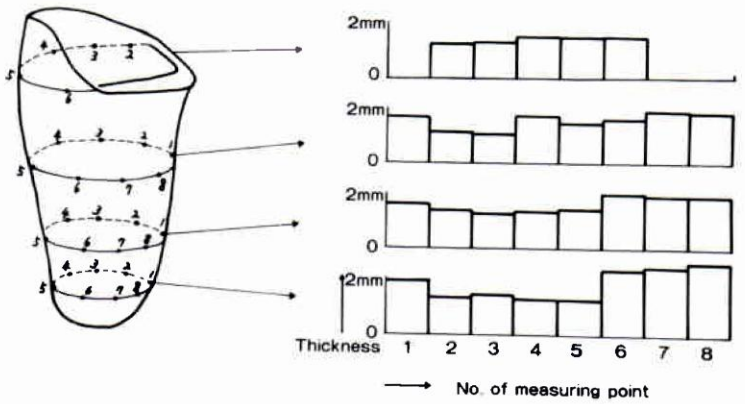


Figure 13. Socket wall thickness at various points.

show measuring points: Number 1 medial, Number 3 anterior, Number 5 lateral and Number 7 posterior, and the even numbers are midpoints in between. The maximum thickness is seen in the most distal point at the posterior side. The minimum is seen also in the most distal point, but at the lateral side. The measurements are 2.5 millimeters maximum and 1.2 millimeters minimum, or approximately a ratio of two to one.

Generally, the anterior and lateral walls are thinner than the posterior and the medial walls. We found that the socket movement of the lateral wall was largest at the second most proximal point, and the thickness of this point is almost similar to the lower points. Therefore, we can say that socket movement of the lateral wall is not a function of the thickness of the socket wall, but rather a function of the change in shape of the soft tissues of the residual limb. Although the lateral wall is thinnest, its strength is sufficient to hold the femur in the original adducted position.

SUMMARY AND CONCLUSION

The ISNY flexible above knee system with a quadrilateral socket has been evaluated biomechanically using linear motion transducers and x-ray. We found that the socket shape changed strictly in response to the muscle activity predominant in each phase of gait. The adduction degree of the femur in the flexible socket compared with a hard socket was almost the same.

AUTHORS

Ichiro Kawamura is from Kawamura Orthopedic Appliances Company. Jiro Kawamura is affiliated with Osaka Rosai Hospital.

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ACKNOWEDGMENT

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Burnout in Orthotics and Prosthetics

Joseph Wanchik, C.O., O.T.R.

INTRODUCTION

A review of the literature on the phenomena of burnout indicates it is one of the major concerns of the 1980's. This syndrome is especially prevalent in professions categorized as caregivers. We, in orthotics and prosthetics, are closely identified with this category and are probably more vulnerable to succumb to burnout than the population at large. As caregivers, we have the responsibility to deliver quality orthotic and prosthetic service to our patients. This can only be accomplished if we maintain our own emotional and physical well-being. A careful look into our work environments will find individuals, perhaps ourselves, who are struggling to maintain this state of wellness. We are cognizant of the many pressures exerted on our profession today, which are more complex than they were a matter of years ago. It is necessary that we update our coping mechanisms to deal with this new stress, or surely we will face the possibility of burning out and losing the dedication most of us have to our profession.

DESCRIPTION

Herbert Freudenberger, a clinical psychologist, coined the term burnout in 1972, and has written two books and authored several articles concerning this subject. He indicates that burnout is wearing out, exhaustion, or failure resulting from excessive demands made on energy, strength, or resources. It can be defined as a reaction to job-related stress that varies in nature with the intensity and duration of the stress itself. It may manifest itself with workers becoming emotionally detached from their job and may ultimately lead them to leave their jobs altogether. Burnout may develop within a worker via a process so gradual that he/she is unaware it is happening and may even refuse to believe anything is wrong.

Individuals with symptoms of burnout will display feelings of excessive or constant physical, emotional, intellectual, and spiritual exhaustion. Their lowered resistance to physical illness may lead to hypertension, ulcers, sleeplessness, headaches, gastrointestinal upset, frequent colds or flu, or musculoskeletal aches and pains. New evidence is mounting that vulnerability to infectious disease and even cancer may be affected by how people react to stress. Researchers are finding that high levels of stress frequently precede illness.

Emotional depletion can lead to depression or anger, excessive drinking, smoking, or drug abuse, and the loss of ability to enjoy friends, family, or leisure time. Intellectual functioning can be hampered by an inability to prioritize tasks, the blocking out of new information, going by the book, and avoidance of responsibility.[1] Social and interpersonal functions become impaired, which can lead to a collapse of personal relationships with colleagues at work and elsewhere. This, in turn, becomes a major stressor and increases vulnerability

to stress.[2] An attempt to avoid co-workers or pass stress onto them increases stress for everyone, including the individual burning out.[2] We have all experienced how difficult it is to enjoy work where there has been a breakdown in communication with fellow employees or supervisors.

Persons suffering from some stage of burnout become less efficient at work and accomplish less even though greater effort may be exerted. They tend to become increasingly inflexible and show behavior that confirms their increased dissatisfaction and pessimism about their job. They may voice concern about their ability to continue working in their present position for a prolonged period of time.

A professional experiencing burnout lacks sympathy and respect for his patients and may develop a cynical and dehumanized perception of them. He may label patients, refer to them in a derogatory manner, or tend to distance himself from any emotional involvement with them. Other symptoms include a feeling of unhappiness with oneself or a tendency to leave a series of jobs in a short period of time in the absence of evidence that one is moving vertically in one's career.[3]

Burnout is a very complex phenomena and the unrelieved problems that lead to it can be caused by a combination of stresses, including those experienced at work. Family problems, faulty ways of relieving stress, and environmental demands over which we have little control are a few of these. Environmental demands could include such events as inflation, rises in taxes and energy costs, loss of a job or moving to a new job, city, or neighborhood, or natural disasters such as fire, flood, earthquakes, or tornados. Our family lives can bring us great amounts of comfort but can also bring the most intense forms of stress. The death of a spouse or close relative, a severe illness, marriage, pregnancy, and gaining a new family member can all produce a great deal of stress.

Often, stressful events occur in our lives over which we have no control, and one must cope with this series of events without choice. There are, however, occasions when the number of stressful events can be controlled. Therefore, it is wise to space them to prevent overload at any given time. Stress does not simply result from a particular negative event; rather it results from a complex interaction between events and a variety of psychological factors, such as a person's expectations and experience, and the presence or absence of a network of caring friends.[4]

Each individual has some inherent ability to cope with stress, but what may be stressful for one person may merely present a challenge to another. We need to realize that stress is not necessarily bad. Some stress is positive and necessary to energize us to do our activities of daily living. There are some people who suffer from stress underload, which can just as easily lead to depression and boredom.

People in helping professions, such as orthotics and prosthetics, tend to suffer from stress overload. It saddens us deeply when we hear a fellow professional has broken down emotionally or physically, or has even taken his own life. If we looked closer into the situation, we would possibly find the person subjected himself to prolonged periods of unrelieved stress and never bothered to develop coping skills that would lead to a more balanced life. Everyone around him may have noticed that negative changes in his life, but were powerless to do anything about it. There are persons who find it very difficult to admit they cannot handle a situation, invest more energy into the problem, and merely intensify the stress.

PREVENTION

The first steps in preventing burnout are to recognize its existence, be aware of personal feelings, and remain open to input received from co-workers, supervisors, friends, and family. These individuals are often the ones who first recognize the burnout symptoms and may be able to help in providing a support system. Many times a relative or friend will mention that we are looking tired or worn out, or that there is a need to slow down or take better care of ourselves.

Most authors agree that burnout usually occurs in stages. Jerry Edelwich and Archie Brodsky note four stages: Stage one (enthusiasm) is characterized by high hopes, high energy, and unrealistic expections. Stage two (stagnation) occurs when the job ceases to be a central force in an indivudal's life. Stage three (frustration) occurs when the individual questions his/her work effectiveness and the value of the job itself. Stage four (apathy) becomes the natural defense mechanism against frustration when workers find themselves in an unsatisfying job they cannot change or leave.

Robert L. Veninga in his book, *The Work Stress Connection*, describes the states as the honeymoon, fuel shortage, chronic symptoms, crisis, and hitting the wall.[8]

Burnout from an industry's or organization's point-of-view can be very costly. Absenteeism, depression, low morale, and impaired decision-making can effect the quality and quantity of work produced. Constant turnover of staff due to burnout can greatly impact on a facility's ability to provide professional services in an uninterrupted and timely fashion.

Another concern for an employer is that in many states, physically and emotionally burned out individuals or their surviving family members can sue stress-inducing employers.[5] The basic legal argument is that the place of employment did not provide a safe and healthy workplace, and as a result, the employee was hurt and deserves compensation. Other states claim that both the damage and the cause can be strictly emotional. Authors on this subject estimate that at any given time, five to 15 percent of employees are at some end stage of the burnout process and two to three times as many are somewhat in the process of burning out and are therefore at risk.[6] Others have proposed the controversial idea that entire organizations may burn out as they make adjustments in their procedures and practices to accommodate the needs of increasing numbers of burned out employees.[7]

Orthotics/prosthetics laboratories are particularly vulnerable, since at no time in history have they been subjected to the type of stresses experienced today. There is the demand to keep up with the explosion of medical and technical knowledge to insure quality and up-to-date treatment, while at the same time deal with insurance companies, unions, employers, and government agencies who are unwilling to pay the full charge for patient services. This, compiled with increased competition from all areas and shortage of trained professional staff, leads to a great deal of stress.

There are several actions we can take to minimize burnout in our own profession. First, we must present realistic job expectations to our student orthotists/prosthetists and those just entering the field in order to help them understand the nature of the stresses involved in our profession. Perhaps a few lectures on this topic noting mature ways of coping with stress would help to cushion the shock of reality when these individuals eventually encounter particularly difficult job situations.

In the long run, it is the responsibility of each individual to recognize the signs of burnout and develop a strategy for dealing with his/her unique situation. Occasionally, being unable to cope does not mean we are failures; it simply means we are human. We spend so much of our day caring for others, why not reserve a little time for caring for each other, especially fellow professionals and staff who are in need of our support. An atmosphere of genuine caring and support for each other in our workplace would do much to reduce stress.

Why is it that many individuals in our profession seem fulfilled, pleased with their accomplishments, and continue to maintain positive relationships with their patients and fellow professionals for many years, while others feel the need to leave the profession after a short period of involvement? The answer, of course, is very complex; however, studies have shown that those individuals who successfully cope with occupational stress have three important characteristics.[8] First, they are problem-solvers. They have a "we can solve this" type of mentality. Rather than endless hours of complaining, they convince themselves that a problem can be managed. They use logic, analytical thought, and data based decision-making

along with imagery, positive visualizations, and creative brainstorming to solve complex issues. They believe that tough times never last, but tough people do. They believe it is impossible to fail totally if you dare try to do something worthwhile. The very fact that they take positive action to resolve an issue markedly lowers the stress of the situation. Second, they keep their work expectations in line with reality. They determine what is reasonable to accomplish in a day's work, make sure major objectives are met, but also set aside time for interruptions and unexpected crises. Persons who have their daily work life governed by interruptions seem to have a high level of job dissatisfaction. Third, those who cope successfully are able to resolve conflict situations. They are able to discern which of the conflicts at work are worth their involvement. Persons in late stages of burnout seem to be involved in all kinds of conflict situations and have arguments with their boss, their colleagues, and even their patients.

A person who is successful in dealing with burnout seeks to reduce stress in all areas of his life. He becomes more conscious of how his body feels and reacts to stress. He listens to what his body tells him in terms of needing more rest, relaxation, or increased physical activity. He no longer blames everyone else for the stress he feels. He looks into himself to see whether his perceptions of a situation are helping to create the stress. He is realistic about his goals in life and does not force himself to try to reach the impossible. He is conscious of the need to change gears from work to rewarding and pleasant physical activities, hobbies, sports, family, or friend relationships. He is willing to discuss his problems with a friend, relative, minister, priest, or counselor to help release pent-up emotions.

We all have a choice of taking a negative or positive view of stressful events in our life. Those who are prone to burnout tend to take a negative view and tell themselves such things as "I've had it," "I give up," "What's the use of trying, it won't work," etc. With this attitude one becomes cynical, apathetic, uncaring, and unproductive. On the other hand, one can use the positive approach and say to himself, "I'm not going to give up—to give up will only hurt myself and other people," "I've handled challenges in the past and I can and will be able to handle this," "I'll work constructively on this one step at a time," "When the going gets tough, I get going." This kind of positive thinking will lead to liking yourself, having a pleasant disposition, and being productive and creative.

Those of us who are managers can introduce some organizational interventions which may help relieve job stress. Particularly, management that allows employees to help make decisions regarding their work environment, job assignments, and work schedules can help them feel they have some control of their work situation.

A manager should look at issues such as:

- Is there an up-to-date accruate job description that has been discussed with the employee so that job expectations are clearly defined?
- Does this employee have sufficient training for the job assigned him?
- Does the employee have time for educational pursuits to update his/her professional or technical knowledge?
- Is his/her workload reasonable and salary competitive?
- Is there an opportunity for career advancement?
- Has sufficient space been provided for the employee to do his work effectively and are the physical surroundings as pleasant as possible?
- Is there a systematic method for using employee input to influence organizational policy?
- Can the supervisor recognize negative effects of stress on the employee so that some action can be taken to reduce it? This may include a less stressful job assignment, a few days off, or the need for the employee to take a vacation.

We must realize that the manner in which we as managers behave may have much influence on whether our employees burn out. Employees treated with respect, support, and dignity will be more productive than those employees who have a boss

they dislike or despise. A good manager will learn to communicate effectively with his employees and be an active listener. He should learn to accept honest criticism from his subordinates and be willing to make changes that will benefit all in the work environment. An employee who is suffering from some stage of burnout needs our support, concern, trust, and acceptance if it is our intent to help him. On the other hand, an employee who has made an incorrect career choice, dislikes his work intensely, or is incapable of performing satisfactorily, should be counseled to leave the profession as job difficulties will inevitably ensue.[9]

CONCLUSION

How close are any of us to burnout? That is a question each of us must answer for ourselves. We must take an honest and close look at our values, perceptions, expectations, communication skills, and the manner in which we treat our fellow human beings. We should feel good about ourselves and realize that we have needs for rest, relaxation, recreation, and physical exercise. We need to know who we are spiritually and develop our inner strength. We have to realize that the maintenance of a positive attitude and good emotional and physical health is really our own responsibility. Every effort should be made to maintain that state of health and well-being so that we can be more effective in treating the patients to whom we are dedicated.

The future of the orthotics/prosthetics profession lies in our ability to cope with stresses that we encounter today. This is particularly important since our greatest recruitment efforts for the profession lie in the example each of us sets in our daily practice. Those who wish to imitate us will be those who have a positive experience with us, perhaps even a patient who has been treated with dignity and respect. Many of us were former patients who were impressed by those who cared for us. Therefore, it behooves all of us to take a closer look at ourselves. We must understand our own needs and feelings in order to make those changes that will lead to good emotional, physical, and spiritual health. Only then can we carry on with the business of helping others.

AUTHOR

Joseph Wanchik, C.O., O.T.R., is Director of Orthotics at the Rehabilitation Institute, Inc., 261 Mack Blvd., Detroit, Michigan 48201.

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Clinical Survey of Upper Extremity Amputees in India

Brig. I.C. Narang, MS, FICS
Lt. Col. B.P. Mathur, MS, M.Phil. (UK)
Lt. Col. Pal Singh, MS
Mrs. V.S. Jape, MA, MA(SW)

INTRODUCTION

A survey of upper limb amputees has been carried out at the Defense Services Artificial Limb Centre, Poona, India. The aim of the survey was primarily to gather information directly from the patients about the utility of upper limb prostheses which are being provided at present, and also analyze factors like etiology, age, sex, and others.

Initially it was planned to send out questionnaires to the patients in order to collect information from a larger number of upper limb amputees. However, since the information collected in this manner might not have been very accurate, it was decided to interview the patients who reported directly to the Centre.

MATERIALS & METHODS

A questionnaire was prepared and 100 unilateral and 30 bilateral upper limb amputees were interviewed individually, and their answers to the questionnaire were recorded.

FINDINGS

Age & Sex Differences

The maximum number of amputations were found to have occurred in the age group 21-50 years as shown in Table 1; i.e. 39 (30 percent) occurring at 21-30 years, 47 (36 percent) at 31-40 years, and 21 (16 percent) in the 41-50 year old age group. It is seen that the maximum number of amputations occurred during the productive years of the individuals, as it is this age group which is more exposed to a hazardous nature of work.

Out of 130 patients surveyed, 124 (95 percent) were males, and there were six (five percent) females.

Status of Patients (Military or Civilians)

Out of 130 patients interviewed, 82 (63 percent) were civilian and 48 (37 percent) were military patients.

Cause of Injury

Table 2 shows the various causative agents leading to amputations among patients in this series.

Trauma was the most prevalent causative agent, with 122 out of 130 patients having lost limbs due to injuries, pre-

Age & Sex Distribution

Age group	0-10	11-20	21-30	31-40	41-50	51-60	Above 60	Total
Males	2	3	38	45	21	11	4	124
Females	—	3	1	2	—	—	—	6
Total	2	6	39	47	21	11	4	130

Table 1.

Cause of Amputation

Causative Agent	No. of Patients	Total	Percentage
Trauma		122	94.0%
Crush Injury	28		23.0%
Vehicle Accident	25		20.5%
Blast Injury	24		19.6%
Train Accident	20		16.4%
Electric Shock	10		8.2%
Shell Injury	6		4.9%
Gun Shot Wound	5		4.1%
Fall from height	4		3.3%
Diseases		6	4.0%
Gangrene (TAO)	4		66.5%
Malignancy	2		33.5%
Congenital	2	2	2.0%

Table 2.

dominantly as a result of crush injuries, vehicle accidents, blast injuries, and train accidents. Diseases and congenital causes accounted for six and two cases, respectively.

It was observed that the 28 cases of crush injuries, the largest number of cases among the trauma group, were predominantly due to agricultural accidents. In India, such injuries, mostly due to thresher machines, are becoming very common—due to rapid mechanization without proper instructions and lack of safety guards in the equipment.

The most common cause of amputation in vehicle accidents, 25 cases, was a result of sustaining injury by another vehicle while resting the elbow on the open window of the patient's own vehicle.

Blast injuries, 24 cases, occurred mostly in military patients who had to handle dangerous explosives. Only a few civilian patients were encountered who had lost a limb as a result of blast injuries.

Level of Amputation

The levels of amputation in unilateral and bilateral cases are shown in Table 3-A and Table 3-B. Out of 130 cases, 100 (77 percent) were unilateral, and 30 (23 percent) were bilateral amputees. Among unilateral amputees, the majority of cases were below elbow amputees, i.e. 55, followed by 32 above elbow amputees.

Among 30 bilateral amputees, 23 patients had at least one below elbow residual limb, i.e., 14 had bilateral below-elbow residual limbs (including one with bilateral wrist disarticulations) and nine patients had below elbow amputations on one side.

The various other combinations of amputations at identical or unidentical sites are shown in Table 3-B.

Dominance

Out of 130 patients, 127 (98 percent) were right-handed, whereas only three (two percent) were left handed. No ambidex-

trous person was encountered. Loss of dominant hand was encountered in 90 patients.

Time lag in prosthetic fitting

Table 4 shows the time lag from the date of injury to prosthetic fitting. It was observed that only 16 (12 percent) were able to get a prosthesis fitted within six months from the date of injury.

For the majority of the patients it took more than six months to get a prosthesis.

The cause for this unusual delay was primarily due to the time taken by the Centre to call up patients, because of its long waiting list.

Distribution of Prostheses Provided

All the patients had body powered conventional upper limb prostheses with hook or hand terminal devices. No patients were using an externally powered prosthesis, due to its non-availability in India.

The distribution of types of prostheses in use was as follows:

Level of Amputations—100 Unilateral Cases

Level of Amputation	No. of Cases RT	LT	Total
Through Shoulder	1	1	2
Above Elbow	21	11	32
Through Elbow	3	1	4
Below Elbow	30	25	55
Through Wrist	2	3	5
Partial Hand	1	1	2
		Total	100

Table 3-A.

Type of Prosthesis	No. of patients	Percentage
Through Shoulder passive prosthesis	2	2%
Above Elbow active prosthesis	32	24%
Through Elbow active prosthesis	4	3%
Below Elbow active prosthesis	55	42%
Through Wrist active prosthesis	5	4%
Partial hand devices: passive & active	2	2%
Bilateral Through Wrist active prosthesis	1	1%
Bilateral Below Elbow active prosthesis	13	10%
Bilateral Above Elbow active prosthesis	4	3%
Bilateral Through Shoulder active prosthesis	3	2%
Unilateral Below Elbow active prosthesis / Unilateral Partial hand device active type	1	1%
Unilateral Below Elbow active prosthesis / Unilateral Above Elbow active prosthesis	7	5%
Unilateral Below Elbow active prosthesis / Unilateral Through Shoulder active prosthesis	1	1%

Level of Amputations—30 Bilateral Cases

At Identical Sites	No.	At Different Levels	No.
Bilateral Through Wrist	1	BE-RT + partial hand	1
Bilateral Below Elbow	13	BE-RT + AE-LT	5
Bilateral Above Elbow	4	BE-LT + AE-RT	2
Bilateral Through Shoulder	3	BE-RT + SD-LT	1
Total	21		9

Table 3-B.

Distribution of Terminal Devices

The various terminal devices that the patients had taken at a time of fitting of the prostheses were as follows (Figures 1-7):

Terminal Device	Unilateral Cases	Bilateral Cases
Hand	94	43
Hook	95	39
Tweezer	94	21
Tumbler Holder	34	20
Spoon holding device	10	32
Knife holding device	15	12
Comb device	—	13
Tooth Brush device	—	6
Shaving device	—	7
Sanitary device	—	16
Writing device	15	18
Office device	9	8
Telephone device	—	2
Driving device	2	—
Spade grip	17	2
Grass cutter device	10	4
Welding device	—	1

Duration of Disability

The duration of disability at the time of interview of the individual patients is shown in Table 5. It is evident from the table that the survey results represent patients who had been disabled recently and also those who had been amputees for a long time.

Duration of Prosthetic Fitting

Table 6 shows the duration since patients had been fitted with prostheses.

Prosthesis Use

Out of 130 patients, 13 (ten percent) discarded their prostheses altogether. They reported to the Centre not for repair or renewal of their prostheses, but for treatment. Such patients were mostly those who had lost their lower limbs, in addition to upper limbs, due to Thromboangitis Obliterans.

117 (90 percent) were using their prostheses at the time of interview. The majority of these patients, i.e. 77 (59 percent), were using the devices solely for cosmetic reasons. They hardly made any use of the functions of the prostheses. Such patients were mostly unilateral amputees, who could perform most of the activities single-handedly. On interrogation about bimanual activities, it came to light that they avoided it, since help was available in their homes as well as places of work, from relatives and colleagues, respectively. Five bilateral amputees were also found not using their prostheses for functional purposes since they had undergone bilateral Krukenberg operations and were functioning with their residual limbs; however, for cosmetic purposes they wore their limbs.

For functional purposes, only 40 patients (34 percent) were using the prostheses. The majority of these patients were bilateral amputees, and their very survival depended upon how well they could make use of their prostheses.

Out of 40 patients who were using their prostheses, 15 were unilateral cases, whereas 25 were bilaterals. The functional gain following prosthetic fitting was found quite satisfactory in the majority of cases. Of the 30 bilateral cases, 23 had at least one below elbow prosthesis (14 bilateral below elbow prostheses and nine unilateral below elbow wearers).

The majority of the bilateral amputees (25) had right sided dominant longer re-

Time Lag

Time Lag	No. of Patients	Percentage
<6 months	16	12%
6-12 months	57	44%
1-1½ yrs.	15	12%
1½-2 yrs.	14	11%
>2 yrs.	28	21%
Total	130	

Table 4.

sidual limbs available to use the prostheses as dominant prostheses. In two cases, however, they had to change dominance to the left side, since they had below elbow amputations on the left and above elbow amputations on the right side.

Among unilateral cases, the whole limb, irrespective of previous dominance, was used as a dominant hand, and the prosthesis was used as a support.

Out of 40 patients, all were using their prostheses for some activities of daily living, 25 for their professional work as well, and 31 for avocational purposes, too.

Use of Terminal Devices

Though every patient was given a large number of terminal devices at the initial fitting, it was observed that of the 130 cases, only 15 unilateral and 25 bilateral patients made use of them. The majority were concerned about cosmesis, and thus rejected unattractive terminal devices for the expense of function, by wearing a passive hand only. Among bilateral cases, however, the acceptance rate was very high, since for functional gain they had to use the terminal devices. They also expressed the view that they would be much happier if the hands could be made more functional.

All 15 unilateral amputees made use of hooks. In addition to a hook, 10 patients used grass cutters (being farmers by profession) and two made use of driving devices.

Among the 25 bilateral amputees, the acceptance of terminal devices was better. The majority of them, in addition to hooks, made use of two to three more terminal devices, mostly for eating and dressing purposes. Though initially bilaterals also took a large number of terminal devices to perform various activities, a number of such devices were rejected due to the difficulties in interchanging the devices. Maximum use was made of hooks to perform most of the activities.

Duration of Disability

Duration of Disability	No. of Patients	Percentage
Up to 2 years	14	11%
2-4 years	12	9%
4-6 years	33	25%
6-8 years	7	5%
8-10 years	18	14%
10-12 years	9	7%
12-14 years	10	8%
14-16 years	11	9%
16-18 years	8	6%
18-20 years	5	4%
Over 20 years	3	2%
Total	130	

Table 5.

Duration of Prosthetic Fitting

Duration of Prosthetic Fitting	No. of Patients	Percentage
Up to 2 years	25	19%
2-4 years	11	8%
4-6 years	30	23%
6-8 years	6	5%
8-10 years	16	12%
10-12 years	8	6%
12-14 years	9	7%
14-16 years	10	8%
16-18 years	7	6%
18-20 years	5	4%
Over 20 years	3	2%
Total	130	

Table 6.

Educational Level

The educational level of upper extremity amputees has been found much higher than expected, and is shown in Table 7.

Educational Levels

Level	No. of Patients	Percentage
Illiterate	9	7%
Primary (up to V)	26	20%
Secondary (V-IX)	39	30%
Post Secondary	24	18%
Tertiary	32	25%
Total	130	

Table 7.

Figure 1. Bilateral, below elbow (R) & through elbow (L), amputee, writing with the help of pencil holding device.

Figure 3. Bilateral amputee, combing hair, with the aid of a hair comb holder. Patient is wearing a tumbler holder on the other side.

Profession Before Amputation

Profession	No. of Patients	Percentage
Students	23	18%
Technicians	34	26%
Drivers	10	8%
Salesmen	2	2%
Soldiers	19	14%
White Collar Job	20	15%
Businessmen	2	2%
Casual Labourers	9	7%
Unemployed	11	8%
Total	130	

Table 8.

Figure 2. Bilateral amputee, drinking water, holding tumbler with the help of tumbler holder; wearing tweezer on the other side.

Profession Before Amputation

Table 8 indicates patients' profession before amputation.

The largest group of amputees belonged to the technician class (34), followed by students (23), white collar workers (20), and soldiers (19).

Figure 4. Bilateral below elbow amputee, eating food with the help of a spoon device. Patient is wearing a tumbler holder on the other side.

Professional and Financial Status Following Prosthetic Fitting

Out of 130 upper limb amputees, 70 had to change their jobs, 34 were offered the same job, and 26 lost their jobs.

The majority of patients in this survey had to change jobs or lose them since their job involved use of both hands, e.g. technicians, drivers, soldiers, labourers.

Due to the changes of jobs, 68 had to accept jobs with less income, but 29 had better jobs financially. Thirty-three patients had no effect on their earning capacity following amputation.

Change of Personality

As far as personality changes are concerned, the proportion of those who professed personality changes in themselves were found more or less equal to those who did not, i.e., 60:70 ratio.

Among 60 patients who felt some change in their personality following amputation, 40 were more anxious, worried, and depressed, whereas 20 felt that now they were more mature and responsible.

Feeling of Being Handicapped

On interrogation, 54 patients out of 130 complained that they felt handicapped and also had personality changes.

Figure 5. Bilateral below elbow amputee using rolling pin to make bread, with the help of hooks.

Seventy-six patients did not feel handicapped (subjectively).

The above feelings were purely personal feelings and had no relevance with functional gain or other factors following prosthetic fitting.

Acceptance by Society

Out of 130 patients interviewed, the majority, i.e. 109, said that they were well accepted by society, whereas 21 felt that they were not.

Family Status

Out of 130 patients, 87 belonged to joint family groups, 33 to nuclear families, and only 10 lived alone.

Since the majority were living with others, they did not feel an urge to be totally independent, as help was always available. This attitude of the patient is supported by the prevalence of the joint family system, culture, and customs of Indian society, and the number of relatives and friends who go out of their way to help such unfortunate members of society. This in turn makes the patient more dependent on others.

Figure 6. Unilateral above elbow amputee, driving a modified scooter, holding the handle with the help of a Universal appliance.

Figure 7. Unilateral above elbow amputee, doing weight lifting, holding bar with a Universal appliance.

Marital Status

Out of 130 patients, at the time of the interview, 92 were married and 38 unmarried.

Of the 92 married ones, 47 were married before amputation, and 45 got married after amputation. This suggests that being handicapped probably does not impede marriage plans.

Marriage prospects of bilateral upper limb amputees in this survey were not encouraging. Out of 30 bilateral amputees, 14 were already married before amputation and were quite acceptable to their spouses. However, the remaining 16 who were unmarried found it difficult to get a partner.

Marriage seemed to affect female patients the most. All the female patients (six) in this series were unmarried, though they were between the ages of 16 and 37.

Sex Life

The survey revealed that the sex life of married amputees was normal and satisfactory. None of the married amputees had complained of any problems like sexual inadequacy or maladjustment towards their partners.

The above may be due to Indian culture and traditions in a male dominated society. Females have to play a submissive role, accept male superiority and stay with their husband, once married, for life.

SUMMARY

A survey of 130 upper extremity amputees has been carried out by collecting information directly from the patients.

Out of 130 cases, 100 were unilateral and 30 were bilateral amputees.

There were only six female patients. The maximum incidence of amputations was encountered in the 20-50 year old age group.

Trauma was the most prevalent cause of amputations, i.e., 94 percent.

Only a very few cases could be fitted with prostheses within six months from time of injury (12 percent). The majority received their initial prosthetic fitting after six months.

The majority of the unilateral amputees did not use their prosthesis for functional purposes. They wore it solely for cosmetic purposes.

In contrast, among bilateral amputees, the use of prostheses for functional purposes was very high, as their very existence depended on their functional gain following prosthetic fitting.

Though initially a large number of terminal devices were taken, the majority

were later rejected. For functional purposes the prosthetic hook was used most often.

The functional gain among bilateral amputees in this series was found quite satisfactory since the majority of them (23 out of 30) had at least one below elbow prosthesis.

All expressed a desire to have a hand, rather than a hook, with more function.

Following amputation, the majority of the patients had to either change their jobs or lost their gainful employment.

Roughly 50 percent of the patients had personality changes following amputation, and felt handicapped.

Acceptance by society and the families of such patients, following amputation, has been of a high order.

There has been no problem for male unilateral amputees to marry following amputation. However, the majority of unmarried bilateral amputees and all female amputees found it difficult to get a partner.

There have not been any psychological problems leading to marital imbalance or break-down in their relationships.

AUTHORS

Brig. Narang is Professor of Orthopaedics, Armed Forces Medical College, Poona, India; Consultant in Prosthetics; and Commandant Artificial Limb Centre, Poona, India.

Lt. Col. Mathur is a Classified Specialist in Surgery and Deputy Commandant Artificial Limb Centre, Poona, India.

Lt. Col. Singh is a Classified Specialist in Surgery, Artificial Limb Centre, Poona, India.

Mrs. Jape is a Medical Social Worker, Artificial Limb Centre, Poona, India.

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Specifications and Fabrication Details for the ISNY Above-Knee Socket System*

Richard Hanak, C.P.
Eric S. Hoffman, C.P.O.

INTRODUCTION

The Icelandic Swedish New York flexible socket system (ISNY) is one of the most significant advances in lower-limb and upper-limb prosthetics[1] in the last two decades. The ISNY system achieves the goal of enhanced patient comfort by providing a thin, pliable, lightweight socket for tissue containment. The thin socket allows better heat dissipation, increased sensory input, and greater freedom for muscle activity as the socket adapts to residual limb changes. The socket is easy and quick to form and modify, it nests in a rigid laminated frame for weight transmission, and the translucence of the vacuum-formed socket aids the prosthetist by serving as a check socket.

The fitting and fabrication techniques referred to in this article are the result of extensive collaboration which began in August, 1982 between Össur Kristinsson of Iceland, the Een Holmgren Company of Sweden, and the Prosthetics and Orthotics Program at New York University. The fabrication procedures as well as the instruction manual[2] represent the cooperative efforts of all these groups.

This collaboration led to the final development of the ISNY Above Knee Socket with initial presentations in September and October 1983 at the ISPO Congress in London and at the AOPA Assembly in Phoenix, respectively. The project culminated with the inauguration of formal courses of instruction at New York University and the Munksjoskolan in January and April, 1984.

SOCKET MATERIALS

For maximum benefit, the prosthetist should have a working knowledge of the materials used in the supporting frame and the thermoplastics used for the flexible socket, in order to provide a maximally flexible, yet durable, system.

Two types of sheet thermoplastics are most commonly used to vacuum-form

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flexible sockets: polyethylene and Surlyn.®† Polyethylene is manufactured in many densities; however, low density is preferred for the ISNY socket because of its greater flexibility. Much disparity exists amongst batches of polyethylene with regard to uniformity and formability. It is therefore difficult to obtain plastic of consistent quality from different manufacturers and distributors. As recommended in "Fabrication Procedures for the ISNY Above-Knee Flexible Socket,"[2] success is more likely with Ethylux,®‡ a low density, molecularly aligned polyethylene.

Surlyn® is more rigid than low density polyethylene and is optically clear. Although most plastics are flexible if drawn thin enough, Surlyn® is more rigid than polyethylene when the same thickness is used.

Each plastic has different molding characteristics. Surlyn® tends to draw less easily than polyethylene, but has more memory retention. If vacuum is not applied while Surlyn® is heated and stretched, it tends to return to its original dimensions while hot. Polyethylene, however, has less memory, draws more easily, and tends not to return. Polyethylene overstretches more readily if used with amputated limbs having bulbous distal ends, where the plastic must stretch and then retract in order to achieve a wrinkle-free socket. For such models, Surlyn® is preferable.

The basic characteristics of polyethylene and Surlyn® may be summarized as:

Ethylux® Polyethylene
Moldability: Relatively easy to mold
Strength: Suitable for average use
Edge finish: Easy to finish
Appearance: Translucent
Cost: Inexpensive

Surlyn®
Moldability: Easy to mold
Strength: Suitable for heavy use
Edge finish: Less easy to finish
Appearance: Transparent
Cost: Expensive, triple the cost of polyethylene

Shrinkage characteristics of both plastics differ, as demonstrated by serial measurements taken of polyethylene and Surlyn® sockets molded over the same plaster model. Length and volume were measured immediately, one day after, and one week after, molding (Table 1). Polyethylene creates a socket whose volume (measured in cubic centimeters), while slightly less than the model, is closer to that of the original model, providing a more legitimate fit and better suspension if total suction is used. Polyethylene shrinks more than Surlyn® in length (measured in milli-

	Percent Change			
	Length		Volume	
	Ethylux® Polyethylene	Surlyn®	Ethylux® Polyethylene	Surlyn®
Directly after Molding	−2.0	−0.7	+ .200	+3.500
One Day after Molding	−2.0	−0.7	+0.002	+3.100
One Week after Molding	−2.4	−0.7	−1.300	+2.500

Table 1.

†Surlyn® is DuPont's trademark for its ionomer resin.
‡Ethylux is Westlake Plastic Company's trademark for its low density polyethylene. P.O. Box 127, Lenni, PA 19052.

meters); thus, model preparation may be adjusted to reflect this property of the material.

SOCKET SPECIFICATIONS

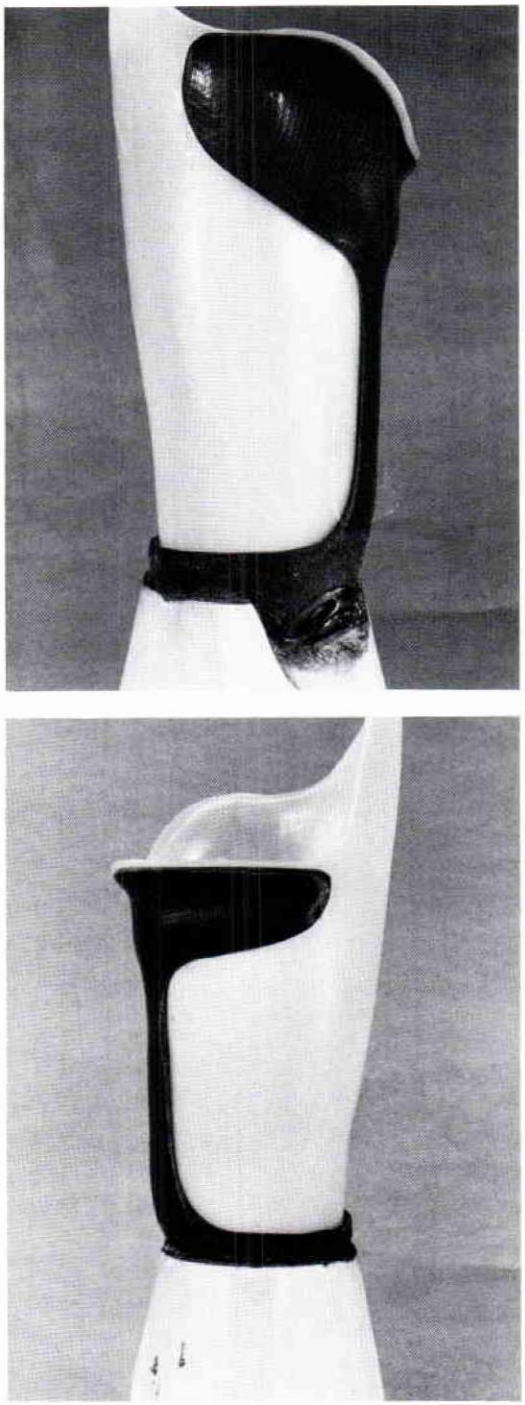
Based on extensive research and clinical services for adults and children and teaching the ISNY system throughout the world, during which hundreds of sockets have been fabricated and worn, socket wall thicknesses may be recommended to generate the desired physical properties. Specifications for the use of polyethylene are based on measurements from 30 sockets, judged by three staff prosthetists as having acceptable flexibility and durability.

Segments of plastic, one square inch in area, were removed from four areas of each socket: mid sections of the posterior, anterior and lateral walls, as well as the proximal-lateral wall in the area of attachment of a Silesian bandage. The average wall thickness for the mid sections were 0.06 inches. The proximal-lateral wall was thicker, approximately 0.88 inches (Table 2). These dimensions were independently corroborated by Jendrzejczk.[3]

Wall Thickness in Inches		
	Mean	Range
Medial, Posterior and Lateral	0.060	0.045–0.065
Proximal Lateral	0.080	0.060–0.090

Table 2.

In addition to wall thickness, attention must be given to the proper finish of the socket edges. The brim should be carefully rolled over the frame to insure adequate socket-frame interlocking and to minimize the risk of socket tears. The brim rollover should be continued past the socket-frame interface to increase reinforcement of the anterior-lateral and posterior-lateral socket corners.



Figures 1-A & 1-B. Anterior view (top photo), posterior view (bottom photo), of socket.

Patient education regarding doffing the ISNY socket will also extend socket life. The socket should not be doffed by putting pressure on the proximal-lateral socket, as is the practice among wearers of rigid suction sockets. Pushing stresses the anterior and posterior corners, leading to premature socket failure.

FRAME SPECIFICATIONS

The carbon-fiber reinforced laminated frame provides an effective support system with minimal socket coverage. The frame is composed of four unified segments: cup area, medial strut, anterior-proximal extension, and posterior-proximal extension (Figures 1-A and 1-B).

The cup area supports and stabilizes the distal socket. The cup is trimmed horizontally at the level where the socket walls approach the vertical. The trim extends over the valve for socket retention and good appearance.

Width of the medial strut is determined by the two inch carbon-fiber tape. The trim extends ¼ inch beyond each edge of the tape. The anterior/proximal extension covers Scarpa's femoral triangle. The proximal border follows the trimline of the socket and extends to the apex of the rectus femoris channel. From this point, the trim returns to the medial strut, passing about 1¾ inches below the deepest point of Scarpa's triangle.

Forming the ischiogluteal seat, the posterior/proximal extension terminates at the posterior/lateral corner. At its midpoint, the posterior frame measures about two inches from top to bottom.

These specifications provide a guide to position the structural layup. The layup recommended is 5-12-5 (carbon fiber-fiberglass-carbon fiber) for the medial strut and 3-6-3 (same material make-up) for the anterior and posterior extensions. For an exceptionally active or heavy individual, an additional one or two layers of carbon-fiber tape may be added to each side of the layup.

Since the anterior/medial corner of the frame in the region of the adductor longus channel is subjected to the greatest stress, care should be taken to keep the layup from shifting in this area. The layup in this area should be stitched in place by hand. One may add layers of Dacron felt in areas, such as the medial brim, which may require relief.

Complete saturation of the layup with polyester or acrylic resin is imperative to avoid delamination and structural weakness. Pierce the dense layers of carbon fiber with an awl to separate the fibers in order to form channels for laminate entry. Once laminated, remove the frame from the positive model and socket carefully to avoid bending segments that may result in delamination. Care is especially important in the anterior medial corner. If removal is difficult, the cast should be broken out.

DISCUSSION

As technology and concepts change, the philosophy of prosthetic fitting must also change. Now the socket itself should be considered conveniently replaceable without requiring the cutting or replacement of the current prosthesis. Pricing must also change to reflect the less expensive, faster socket change. The prosthetic profession has entered an era in which the socket can be replaced regularly as we now replace worn socks, to maintain and ensure proper fit and comfort. Attention to the details of design and fabrication to provide the greatest comfort through a proper balance of socket flexibility and durability will markedly increase patient satisfaction and extend the life of the prosthesis as an optimally fitting device.

AUTHORS

Richard Hanak, C.P. and Eric Hoffman, C.P.O. are members of the prosthetics and orthotics department of the New York University Medical Center's Post Graduate Medical School, 550 First Avenue, New York, NY 10016.

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Non Ischial Weight Bearing Soft Socket Design

Dale A. Berry, C.P.(C)

INTRODUCTION

The criteria used for fitting the above knee socket seems somewhat ingrained into the prosthetic community. The rationale of socket design taught by most institutes of education has been regarded as the critique and guideline for above knee prosthetics. This article's intent is not to disregard the "Berkeley" quadrilateral socket design as inadequate—a good number of amputees are ambulating comfortably on limbs using its principles—yet a closer evaluation of the criteria appears warranted due to the very nature of some of the socket's shape requirements.

CONSIDERATIONS

The medial two-thirds of the anterior wall is the area of the Scarpa's or femoral triangle. Anatomically, the femoral artery, nerve, and vein are located in this area. It presents itself as a pressure sensitive area to which as little localized pressure as possible should be applied. On close examination of a "Berkeley" quadrilateral socket, bivalved through the Scarpa's triangle, it becomes apparent that the socket is becoming choked at a progressive rate from the zero to four inch level below the height of the ischium. This suggests that the excessive pressure and tapering of the brim over major blood flow areas may be a contributing factor to muscle fatigue and distal edema problems (Figures 1 and 2).

Moving laterally on the anterior wall, the socket expands to the rectus femorus channel. When reviewing the characteristics of the rectus femorus, it is a site of high activity during ambulation and, more importantly, the muscle changes shape and position during contraction. Keying the muscle into a channel provides an area for the muscle to work against, aiding in muscle fatigue and poor gait habits. The point to note is that as active as the muscle is, and as radical as its change in shape and position, the volume of the muscle remains constant at all times.

On evaluating the posterior wall design, the basic premise of the Berkeley socket has been "the ischial tuberosity can tolerate total weight bearing, therefore the ischial tuberosity must bear total weight." This one stipulation in itself tends to explain other socket requirements and inefficiencies experienced during socket fit. With the ischial tuberosity posteriorly positioned, both the sciatic nerve and hamstring tendon are bowed sharply over the posterior brim. This tends to cause a slight burning

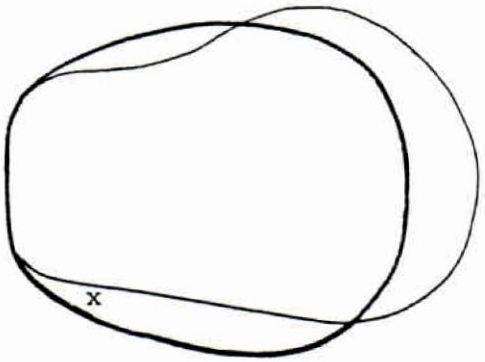

Figure 1. Overlay of the Berkeley ischial weight bearing quadrilateral socket and IPOS soft socket design. The Berkeley shape has a 3" AP, 6" ML dimension with a 46 cm. circumference. The IPOS soft socket design has a 46 cm. circumference with AP and ML as dictated by the casting brim. The sizing ratio of these brims have been calculated on a basis of average residual limb size, therefore, 85 to 90% of patients can be provided a secure fit without significant modification to the brim or positive mold. The "X" indicates the preferred location of the ischial tuberosity for both sockets.

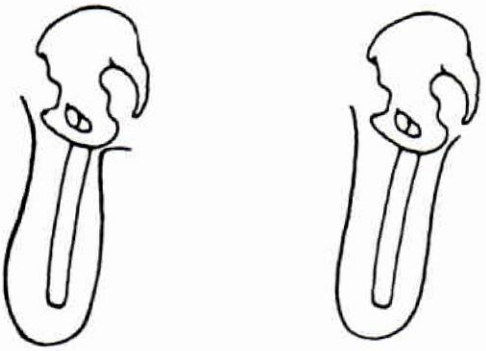

Figure 2. Socket shape of Berkeley quadrilateral ischial weight bearing socket (left) and IPOS soft socket (right) while bivalved on a sagittal plane at the ischial tuberosity and apex of the Scarpa's triangle with relation to skeletal positioning.

sensation and leads to muscle fatigue. With ischial weight bearing, the necessity of total contact along the femur to maintain lateral stability and an adduction angle is self-evident. This rationale presents itself as a basic cause and effect. If the ischial tuberosity wasn't positioned firmly on a pivot point (the posterior shelf) the femur would not be pushed laterally to such an extreme degree.

With respect to maintaining adduction angle, anatomically, the majority of hip adductors originate in the pubic region and insert in the upper half of the femur with some inserting at the trochanteric region. This tends to suggest that maintenance of the proper adduction angle can be maintained at a more proximal level along the femur.

When assessing the degree of muscle activity at the ischial level in a Berkeley socket, the levels of output can be listed: anterior, posterior, medial, and lateral quadrants, in order of diminishing activity. The highest levels of natural muscle activity during walking take place on the anterior and posterior aspect of the brim, yet this is the area that displays the greatest amount of compression in a Berkeley brim. To further complicate the fitting process of a suction total contact socket, a series of reduction tables was devised in order to apply a varying degree of tension on the tissue. It appears somewhat inappropriate to radically modify any cast taken from a patient; if the plaster negative fit the patient well and maintained a comfortable fit, why change it?

Upon evaluation of the criteria for the Berkeley quadrilateral socket, it seems that the entire casting, cast modification, and fitting rationale revolve around the fact that ischial weight bearing is essential in order to maintain proper socket fit and prosthetic gait. However, ischial weight bearing may often be the cause and catalyst of the majority of socket comfort and gait inadequacies. Thus, an alternative socket

shape seems appropriate in an attempt to provide the amputee with a comfortable, functional prosthesis. A significant development in above knee fitting has been the progression of the Active Shaft[1] or flexible socket. The subsequent adoption of this system by the North American prosthetic community is rapidly increasing, yet with varying levels of success. A possible explanation for this may be the fact that the outer carbon acrylic frame and flexible socket have been successfully applied, but no regard appears to have been paid to possibly the most important factor of the flexible socket, the shape and resultant tissue containment.

It is unfortunate that this critical point appears lost in the translation of literature from Europe to the United States. This factor perhaps explains difficulties experienced in North America and not in Europe. One disadvantage of the flexible socket has been stress fractures and socket cracking, an occurrence noticed here but not commonly experienced in Europe, which tends to suggest that socket design with radical channels and corners with excessive tension on active muscles aid in this plastic failure. Also, lateral instability is a common occurrence, caused by ischial weight bearing, insufficient medio-lateral contact, and flexible counter pressure along the femoral shaft. This is a problem not experienced with European socket design.

In developing and designing a functional socket shape, the residual limb and its demands were reevaluated to determine the goals and considerations for a socket.

These considerations for the socket include:

- the ability to accommodate the highest degree of muscle activity possible
- allowance for easy donning and doffing
- no impairment of blood flow
- no excessive pressure on bony landmarks
- constant uniform tension on the limb
- accurate casting method
- consideration for structural strength of the socket
- maintenance of the ischial tuberosity inside the socket

Each wall of the socket requires specific demands to provide a well fitting prosthesis with a stable gait. The following criteria will provide an excellent foundation for a functional flexible socket.

A SOFT SOCKET DESIGN

This socket design, though designed for a flexible interface, will increase muscle activity and circulation, decrease muscle fatigue, and benefit in patient comfort when used with a laminated rigid socket. In addition, during early development stages, ischial weight bearing was integrated into this socket design and found to provide superior comfort and gait over the Berkeley quadrilateral ischial weight bearing socket shapes. The ischial weight bearing design is referred to as the "Hard Socket Design."

THE ANTERIOR WALL

Anatomical Considerations

—Adductor longus
—Sartorius
—Rectus femoris
—Tensor facia lata
—Femoral artery
—Femoral nerve
—Femoral vein
—Pubic tubercle
—Inguinal ligament

Criteria

- The region over the medial ⅔ of the anterior wall contains the femoral triangle (the femoral nerve, vein, and artery). This area should provide uniform tension without excessive socket grooves or bulges.
- The medial and lateral border of the femoral triangle are the adductor longus and sartorius muscles, both highly active during the walking cycle. Uniform tension without restrictive socket shape should be applied at these points.

[1]Registered: 1976 in West Germany by IPOS K.G.

- The inguinal ligament borders the proximal border of the triangle. During sitting this ligament provides a natural crease between the anterior superior iliac spine and the pubic tubercle. Care should be taken to shape the brim along this landmark and not to exceed proximally past it.
- The rectus femorus and tensor facia latae accommodate the lateral third of the anterior wall. This is perhaps the region of the highest level of muscle activity in regard to the muscles changing shape and position during walking. This area should be uniform in shape and consistency without any restrictive angles or channels for the muscles to work against.

POSTERIOR WALL

Anatomical Considerations

—Ischial tuberosity
—Hamstring group
—Gluteus maximus

Posterior Wall Criteria

- The ischial tuberosity should be maintained inside the socket, and located against the posterior radius of the brim. By maintaining the ischial tuberosity against the socket wall, it makes a good reference point to ensure proper socket fit. This allows for unimpeded muscle activity and blood flow, and allows the ischium to accommodate normal sensation during sitting.
- The gluteal shelf should remain uniform with the gluteal fold, cupping about the posterior lateral corner and maintaining uniform tension.
- The shelf should be rolled to allow for a smooth transition between the brim and posterior wall.
- The relationship between the lateral wall and posterior brim should remain constant with the degree of residual limb adduction.
- The angle between the medial and posterior wall should correspond to the negative impression of the amputee's limb.

MEDIAL WALL

Anatomical Considerations

—Pubis
—Adductor longus
—Adductor magnus
—Gracilis
—Hamstrings tendon

Medial Wall Criteria

- This wall should be made relatively flat so as not to interfere with the sound limb.
- The brim should be sloping distally from the posterior shelf to give room for the pubis and to aid in function and relief for the adductor longus.
- The anterior medial corner should have a smooth radius allowing room for the adductus longus tendon.
- The posterior medial arch should have a uniform radius to allow for free uninhibited muscle activity.

LATERAL WALL

Anatomical Considerations

—Vastus lateralus
—Greater trochanter
—Gluteus maximus
—Femoral shaft

Criteria

- The lateral wall should be maintained with uniform tension and pressure. The angle of adduction to maintain proper gait is achieved at the trochanteric level; therefore, increased proximal and distal trochanteric contact should be maintained along the proximal lateral brim.
- The greater trochanter should be noted and adequately padded. Contact in this area aids in maintaining proper gait and socket function.
- The length of the wall should proceed uniformly from the anterior brim to encompass the greater trochanter, not exceeding the level of the iliac spine.
- The general line of the lateral wall should be parallel with the medial wall.

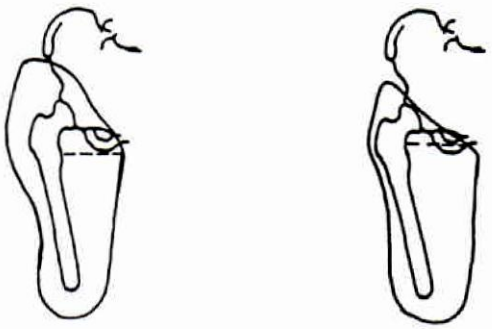

Figure 3. Socket shape of the Berkeley ischial weight bearing socket (left) and IPOS soft socket (right) while bivalved on a frontal plane with relation to skeletal positioning.

TAKING THE NEGATIVE IMPRESSION

To take an impression of the limb, a flexible casting brim is used to maintain the proper shape at the ischial level. The brim is held in place by a shoulder harness, allowing the brim to remain in a stable position in relation to the body, and to hold the femur in a relative degree of adduction and flexion. The measurement recorded from the patient's residual limb is the circumference at the ischial level to aid in selecting the proper brim size. No other measurements are required. All measurements will be recorded on the negative impression. Care is taken for a well fitting mold. This will be reflected in the degree of modification required and fit of the socket.

A wet compression Modelsoft stockinette is placed over the distal limb and brim, giving a uniform compression throughout the residual limb and a smooth transition between the brim and soft tissue. On a conical or bulbous limb, the distal aspect of the brim can be modified with scissors. By cutting slits in the brim, one can allow for a very clean flow of the tissue at the brim's distal edge. The Modelsoft is pulled on and then slightly pulled back distally and tied off so as not to "mushroom" the limb's soft tissue, as commonly happens with a sewn casting sock. The femur is held in its relative position while the plaster hardens with a counter pressure on the medial aspect of the limb.

CAST MODIFICATION

Once a patient has been measured for a total contact socket and has stated the mold was "comfortable," it appears inappropriate to start using a reduction table and measuring device to reduce the positive model dramatically, changing both the shape and volume. Using the aforementioned impression method, the negative mold is taken to be correct, needing only a slight modification. If the shape fits the patient once, it will fit the patient again. At the proximal brim area, modification consists of smoothing the plaster to an even consistency. For the distal aspect of the socket, slight modification or reduction is done, depending on the tissue consistency of the patient. If a very soft residual limb prevails, the positive model circumference is reduced one centimeter from the measurement of the model. On a firm limb, one-half centimeter is reduced. In regard to the question of total contact, although it is not necessary, it is preferred, to aid in proprioception. In terms of valve placement, the most common North American position is the distal medial portion of the socket, highly regarded as the most pleasing cosmetic position and easiest for the patient to don the prosthesis. A consideration to the medial valve placement often disregarded is that the distal lateral femur has very little natural padding. This lack of natural padding is even further reduced by the action of the pull sock being drawn medially during donning of the prosthesis.

Distal lateral placement of the suction valve presents itself as a more suitable position, due to the fact that the excessive tissue covering the distal-medial aspect of the limb can be drawn around the distal-lateral aspect of the limb by the pull sock, thereby providing a natural pad to this sensitive area. It is interesting to note that the distal lateral valve placement is preferred in the West German prosthetic community.

CONCLUSION

In an attempt to provide the above knee amputee with a comfortable prosthesis, numerous socket shapes, designs, and casting techniques are used throughout the prosthetic community. Recently, there has been an influx of ideas and radical changes to the steadfast "rules" for the above knee socket shape.

The intent of this article is to present the basic principles and rationale behind the "European" soft socket design as compared to the standard ischial weight bearing Berkeley quadrilateral socket.

AUTHOR

Dale A. Berry, C.P.(C) is with IPOS. For more information contact: IPOS USA, 2045 Niagara Falls Blvd., LPO 320, Niagara Falls, N.Y. 14304, 1-800-626-2612; and IPOS CANADA, 7 Boswell St., P.O. Box 321, Simcoe, Ontario N3Y 4L2, 1-800-265-8033.

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A Cranio/Spinal Positioning Device for the Treatment of Ependymoma

Herbert G. Smith, B.S., M.B.A., C.P.
Stephanie L. Fertman, M.D.
Allen G. Meek, M.D.
David LaBelle, A.A.S.

INTRODUCTION

Ependymomas are glial tumors of the central nervous system which are treated with a combination of surgery and radiation.

Post surgical radiation is a critical procedure because the entire cranio/spinal region is often treated. Such radiation procedures often use a cranio/spinal positioning device for precise reproduction of radiation from cranium through the spinal canal.

This paper addresses the clinical nature and treatment of ependymomas. Finally, the materials and techniques for fabricating a cranio/spinal positioning device will be discussed.

THE CLINICAL NATURE OF EPENDYMOMAS

Ependymomas arise from ependymal cells lining the ventricular cavities and central canal of the spinal cord. Overall they represent approximately five percent of all brain tumors, less than 10 percent of all gliomas, and 24 percent of all intra-spinal tumors. Ependymomas may occur in all age groups, with over one-half occuring in children and young adults.

Approximately one-half of ependymomas arise intra-cranially and the other half intra-spinally. A significant number of cranial tumors protrude into the upper cervical subarachnoid space.

Ependymomas are graded from 1 to 4. Most of the tumors are low grade 1 and 2. Eighty percent of spinal tumors and 60 percent of intra-cranial tumors are low grade. Grades 3 and 4 are considered to be malignant ependymomas.

Ependymomas show several major routes of spread. They are not encapsulated and tend to be locally invasive, extending into ependymal-line spaces. They can seed the cerebral spinal fluid (CSF) and tumor cells can implant and grow anywhere within the CSF pathways, cranially and spinally. In the late stages they may spread to adjacent dura, bone, and scalp. Rarely, extra-central nervous system metastasis can occur, usually after repeated surgical procedures.[3]

The presenting symptoms relate to the tumor location. Intra-ventricular tumors obstruct the flow of CSF and the patients typically present with signs and symptoms of increased intracranial pressure; i.e. papilledema, headaches, nausea, vomiting, ataxia, and incoordination. Diagnostic studies will include skull x-rays, and head

CT scans. In addition to visualization of the tumor mass, these studies may also show enlargement of and erosion of the sella turcica, separation of the cranial sutures in a young child, and obstructive hydrocephalus. Ventricular shunting may be necessary to relieve the obstruction to the CSF flow before a more definitive procedure is undertaken. Spinal tumors produce spinal cord and nerve root compression and are visualized on myelography.

TREATMENT OF EPENDYMOMAS

The treatment for ependymoma includes surgical resection with removal of as much tumor as is safely possible. These tumors may involve vital structures, and occasionally only decompression and biopsy can be performed. Surgery alone provides a five year survival of 16 percent.[2] Post operative radiation has been shown to significantly improve local tumor control and survival for these patients.[3]

The treatment volume and dosage is based on the location of the primary tumor, areas of extension, and occurrence or estimated risk of CSF seeding. For high risk patients, cranio/spinal radiation is given. The entire neuraxis is the target for radiation, higher dosages given to areas of known tumor, and lower dosages given as prophylactic treatment to areas at risk for subclinical disease. This has been shown to virtually eliminate the later development of CSF seeding. The primary tumor site remains the major site for tumor recurrence after this treatment. This may be due to the limitations on the total dosage that can be safely administered to the primary tumor located in the spinal cord (5,000 rads) or posterior fossa (5,500 rads) without excessive risk of development of induced spinal cord radiation myelitis or cerebral necrosis.

The University of Rochester Cancer Center, Rochester, New York, has made recommendations on the postoperative radiotherapeutic treatment of ependymomas based on local tumor control, patterns of spread, and normal tissue tolerance.[5] Low grade supratentorial tumors are treated with whole brain radiation. Low grade infratentorial tumors are treated with whole brain fields with cervical cord extension to C-5. High grade tumors at any site, or any tumor with positive CSF for malignant cells and/or subarachnoid seeding on myelography are given cranio/spinal radiation. Low grade spinal cord tumors are given spinal cord fields. The recommended total dosages are 4,500 rads to the whole brain, 5,500 rads to the primary tumor volume if intracranial, and 5,000 rads if intra-spinal, 3,000-4,000 rads to the spinal cord, prophylactic treatment depending on the status of the subarachnoid space.

The spinal cord is the most radiosensitive structure treated with the cranio/spinal radiation. It cannot repair radiation induced damage. Underdosage of parts of the spinal cord could lead to tumor recurrence, while overdosage could lead to radionecrosis and permanent neurological deficits. With cranio/spinal radiation, the spinal cord is treated with several radiation beams with different angles of divergence. To optimize the dosage at the field junction regions, several measures are taken. The collimator angle for the brain field is rotated to match the angle of divergence from the beam to the upper spinal field. Field junction gapping is performed. Small calculated gaps, usually one or two centimeters, are located on the skin between consecutive fields. As the radiation beams hit the skin, a "cold" or low dose region will occur on the skin, but the beams will diverge to intersect at the spinal cord region in the body. The skin gap position is moved inferiorly with each daily treatment, in cycles of three or four. This is known as "feathering" and is done to smooth out the inhomogeneity of dosage at the spinal cord at the gap regions. Areas of significant under or overdosage are to be avoided. Computer dosimetry is often used to aid in treatment planning.[7]

The quality of life in long term survivors tends to be good. The majority of patients lead active and useful lives. The side effects from the treatment can be divided into acute and chronic. The acute side effects occur during or just after treatment and are

usually transient. These include hair loss, skin erythema, mucosititis of the upper respiratory and digestive tract, nausea, and myelosupression. Chronic side effects occur months to years following treatment and may be permanent. They are more severe the younger the patient is at treatment. They often do not occur at all in the adult patient. These include neuropsychiatric and intellectual impairment, endocrine dysfunction (especially growth hormone deficiency), growth disturbance secondary to spine radiation, and carcinogenesis, especially a small risk of induction of thyroid neoplasis.[8]

In summary, multiple separate radiation treatments are necessary for maximum radiation benefit, and different angles of divergence and sectors of radiation are also required during different treatment sessions. To increase the assurance of even radiation throughout the above process, minimizing the possibility of cold and hot spots, a cranio/spinal positioning device may be constructed (Figure 1). Cold spots will, as mentioned, increase the possibility of recurring tumors. Hot spots, particularly of the spinal cord, may cause permanent paralysis.

CONSTRUCTION OF A CRANIO/SPINAL POSITIONING DEVICE

Materials

- One box extra fast-setting 4" plaster
- One box extra fast-setting 6" plaster
- One bag 4" webril
- Six foot length 6" or 8" stockinette
- Two foot length 4" stockinette
- One bandage scissor
- Two indelible pencils

Procedure

Six or eight inch stockinette (whichever is appropriate) is applied to the patient with arms inside the stockinette (fleshy or obese patients should be cast with arms out of the negative impression). The patient is then placed on the simulator in the supine position. A nine centimeter hole is cut in the four inch stockinette approximately 12 centimeters from one end. The short end is pulled over the patient's head until the hole frees the nose and mouth area (Figure 2). The eyes, chin, and other facial tissue surrounding the nose and mouth must be covered with stockinette and later included in the negative impression.

The oncology technician now positions the patient's head in a flexed position, reducing the cervical curve and aligning the torso visually using an anterior laser reference which bisects the sagittal plane (Figures 2 and 3). When visual alignment is achieved, the patient is fluoroscoped from the sacrum through the cranium to assure linear progression of the spinal column and head.

Lateral lasers are now set to bisect both the right and left frontal planes. A second set of lateral lasers perpendicular to those above create a cross reference. This cross reference should initially be located just distal to the acromion; then the perpendicular reference is moved superiorly to the skull (Figure 3). If a clear reference is not attainable, just proximal to the ear, adjust the mid frontal plane reference to attain maximum reference coordinates at both the skull and the acromion area. Once this common plane is located, start superiorly to transfer the bisecting reference lines, first to the skull, just above the ear, then to the acromion area, and finally to a point at the mid thoracic level. To do so, cut small holes in the stockinette and apply a cross to the skin at the laser intersections. These

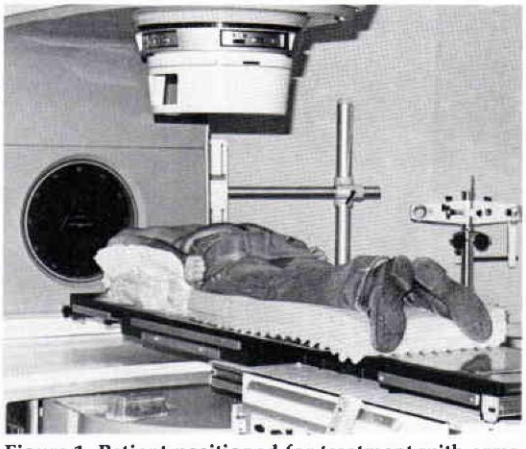

Figure 1. Patient positioned for treatment with arms inside the negative impression.

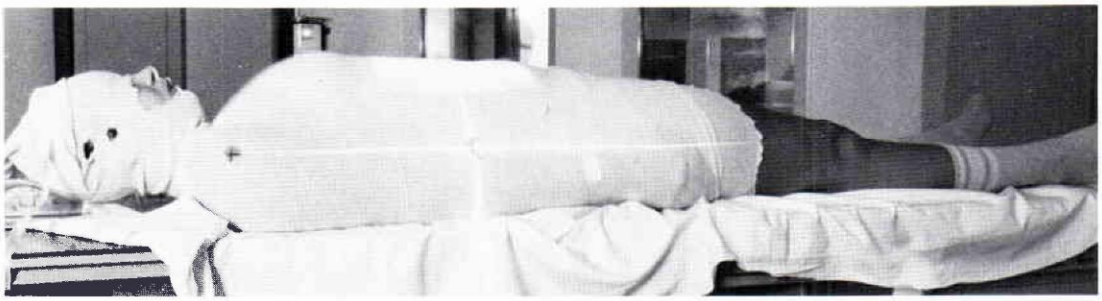

Figure 2. Patient positioned on simulator ready for the taking of a negative impression (note laser intersection at mid-thoracic level).

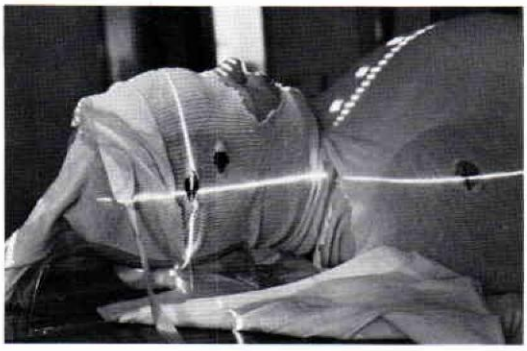

Figure 3. Patient being aligned with lasers at the cranium (above the ear) and at the acromion. Note the anterior reference grid to help determine the length and feather points of radiation. Also note the plastic head cup used to reduce cervical curve.

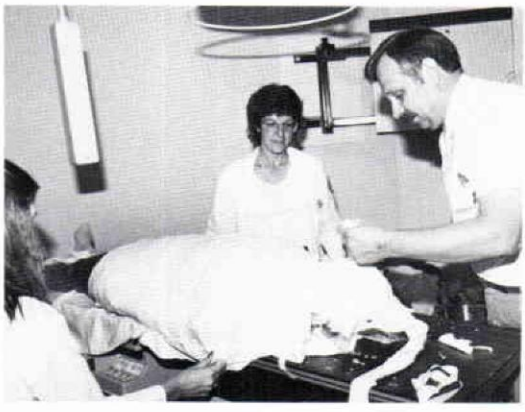

Figure 4. Application of plaster to neck area after applying webril.

reference lines help assure the established alignment prior, during, and after casting. After alignment is complete, webril is applied, two to three layers, over the entire anterior head and neck to mid frontal plane (Figure 4). Continue applying webril over the entire anterior torso to a point 10 centimeters distal to the perineum. The medial and lateral edges of the webril for the negative impression of the torso should radiate well past the mid frontal line to the positioning table.

Rapidly apply 4" plaster strips of two layers thickness to the head, neck, and superior shoulder level while leaving access to the nose, mouth, and alignment holes. The chin, forehead, and eyes must be cast. Continue casting by applying two layers of six inch plaster from right to left as far posteriorly as possible on both sides. Cover the torso completely—encompassing the arms, which are at the patient's side—and casting to 10 centimeters below the perineum. Leave reference holes open. Then apply two layers of six inch plaster over the entire anterior surface from superior to inferior. Finally, reinforce the neck and shoulder area with two additional layers of plaster bandage.

Realign the laser reference coordinates and re-examine the final position. If these visual coordinates align within satisfactory parameters, the patient is fluoroscoped as a secondary alignment check.

Finally, transfer the mid-frontal laser mark onto the negative mold with an indelible pencil (Figure 5). This line must be scribed from superior cranial to the distal aspect of the negative mold. After the line is completed, lift the mold off the patient, leaving the stockinette in place.

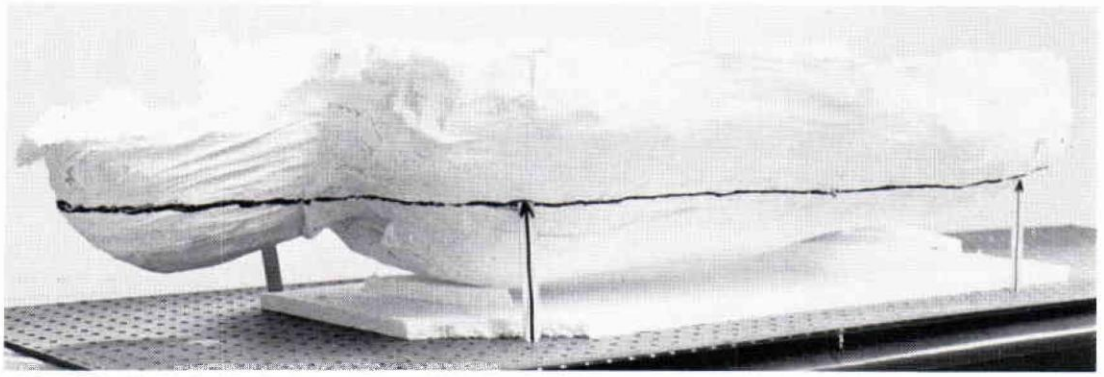

Figure 5. Mid-frontal plane line on mold is parallel to the pressed board base.

Figure 6. Unfinished mouth/nose well and drilling of the lateral breathing holes.

Materials for Mounting of the Negative Mold

- Plaster bandage, six inch
- ¼" perforated pressed board, 21" × 6'
- One roll masking tape, two inch
- Heavy brown paper (90 lb.)
- ½ gallon Kingsley foam
- 10 cans insulation foam
- One inch thick styrofoam sheets
- Stockinette, eight inch and four inch spray glue
- 4 cm. hole saw w/power drill
- Skiving knife
- Utility knife
- Large scissors
- Cast cutter

With cast cutters and large scissors, trim and smooth all edges. Those of the torso should be left as high as possible. However, the head and neck trim lines will be determined by the physicist (we have radiated through the negative mold and maintained accurate depth of penetration). Finally, trim the nose and mouth opening to a symmetrical square opening and apply masking tape over the outside of this opening.

Prepare the quarter inch pressed board by applying masking tape over the holes on the rough side of the board (Figure 4). Place the board on a flat level work area which has been covered with paper.

Locate the negative mold, head down, on the board, so that the head portion is at one end of the board. Put styrofoam blocks under the torso, lifting the mold high enough so that the nose will be well clear of the baseboard upon completion. Carefully align the transcribed laser reference line on the mold with the pressed board base, assuring these references are parallel from superior to inferior aspects (Figure 5). Then the parallel references are secured with styrofoam or wood blocks, and the nose clearance is re-examined.

Construct a brown paper form around the head, neck, and upper shoulder area. Secure this form to the board with masking tape. Mix one-half to one quart of Kingsley foam and pour it into the molded area, and let cure (Figure 8). Once the head, neck, and shoulder area is secure, use styrofoam blocks to fill the large gaps between the cast and base, and pour one-half to one quart of Kingsley foam down the mid-line of the negative mold in three intervals. When this has cured, inject insulation foam in the gaps of the styrofoam. Prepare a paper form to surround the circumference of the negative mold and inject foam to fill the

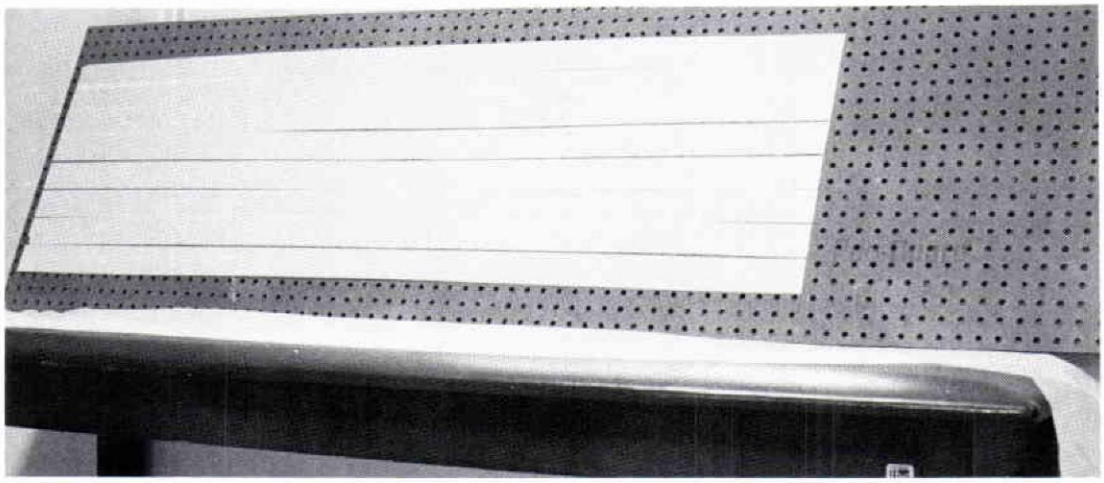

Figure 7. Masking tape applied to pressed board.

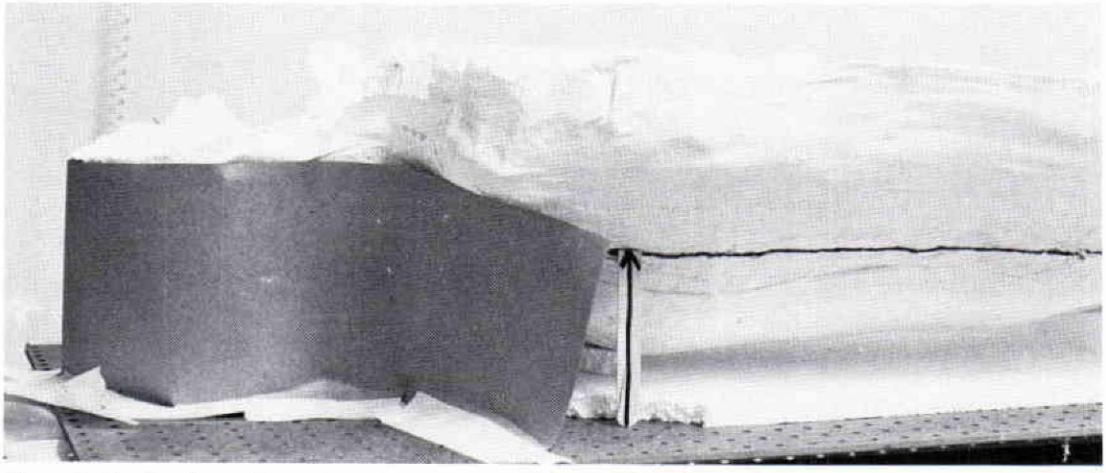

Figure 8. Head/neck area formed to pour Kingsley Foam. Be certain that the parallel alignment between the mold and base board is maintained during this procedure.

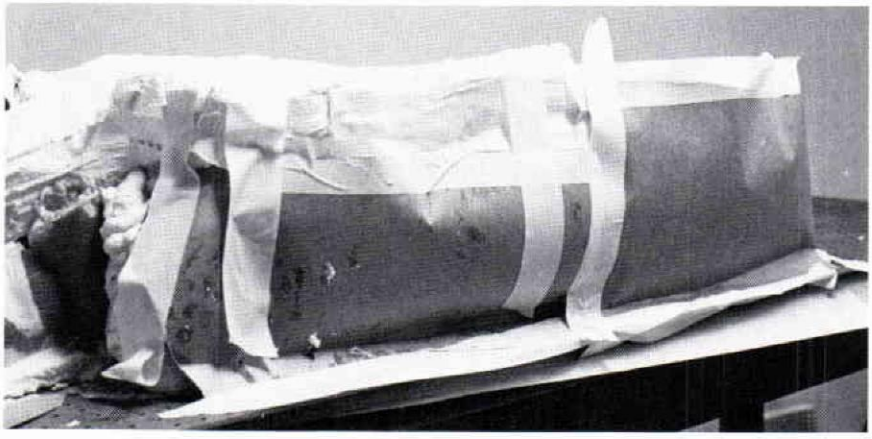

Figure 9. Entire mold formed with paper, and foamed.

Figure 10. Lateral breathing hole must be clear to mouth/nose well at the level of the base board.

form (Figure 9). Let this foam cure overnight. If the patient is heavy or large, a final layer of Kingsley foam should be formed over the outer surface to insure rigidity.

Trim the side walls of foam flat with a large skiving knife. The foam should extend no higher than the mid-frontal plane of the head, cervical, and superior shoulder level. Trim the foam as high as the plaster trim line for the torso.

Cut through the masking tape and foam of the nose/mouth area by removing all foam material down to the pressed board base (Figure 6). This constructs a well within which the nose and mouth fit. Using the 4 centimeter hole saw, drill medial and lateral breathing holes perpendicular and centered in the transverse plane with the nose/mouth relief at the level of the pressed board (Figures 6 and 10).

Cut a length of stockinette which will cover the inside surface of the negative mold, and drape over the sides, two inches past the pressed board. Then cut this piece of stockinette length wise.

Apply spray glue to the inside of the negative mold to which the above stockinette is to be applied. At this time, smooth webril and add additional webril where necessary to fill gaps. Immediately apply flat stockinette at the center of the negative mold and work the fabric smoothly to the edges. Continue applying stockinette until the entire mold is lined (Figure 11). Strips of stockinette should be applied to the nose/mouth relief before the head is lined (Figure 12). Additionally, allow extra

Figure 11. Completed negative mold covered with stockinette.

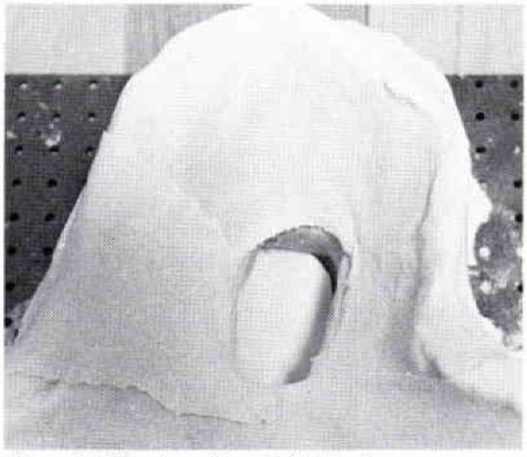

Figure 12. Nose/mouth well finished.

stockinette to drape over the distal edge of the torso. Glue perimeter flaps to side walls and to the underside of the board (Figure 11). All glue must dry well before use of the mold by the patient.

A foam pad is placed at the bottom of the nose/mouth relief (Figure 12). Foam sheets or blocks are cut to support the lower extremities.

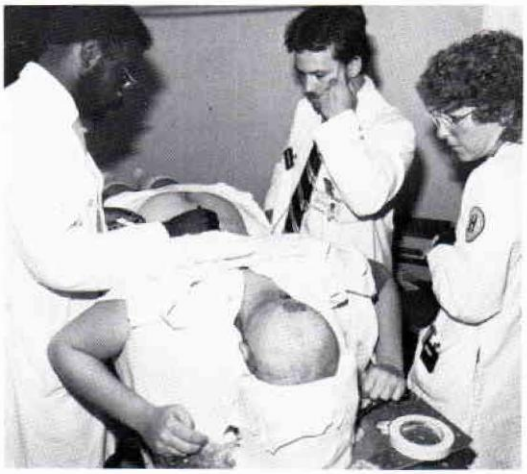

Figure 13. Patient in arm-out position being visually aligned.

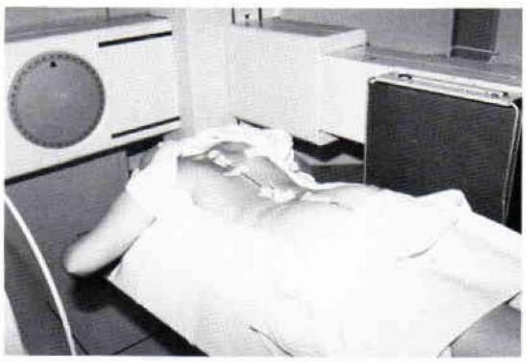

Figure 14. Patient in arm-out position with lead strip taped over spine for flouroscopic alignment.

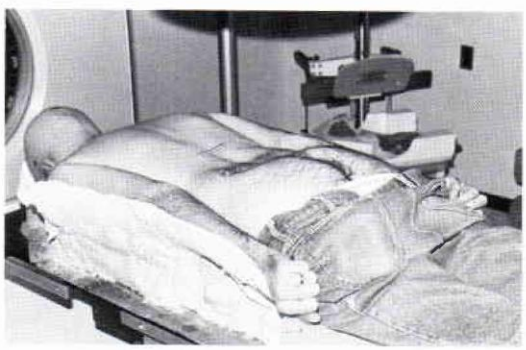

Figure 15. Patient ready for treatment (arms in position). Note the three feather lines at the lower thoracic region and reference marks on the posterior and lateral skull.

The completed appliance is placed on the simulator for final patient alignment. The patient should be instructed to lie straight down into the device, as this will achieve the best reproduceable alignment. If the patient enters by sliding up into the mold, displacement of soft tissue impedes proper alignment of the patient into appliance reliefs, resulting in poor reproduceable alignment.

A light reference is then placed along the posterior mid-sagittal. Palpate the vertebrae to ensure the laser is centered on the vertebrae. Shift the patient slightly to achieve a visual alignment (Figure 13).

Next, medial/lateral laser quadrants are applied to the skull, usually on the ears, if the quadrants are similarly located on both ears. The patient's head is now visually aligned.

Finally, the patient is fluoroscoped to substantiate vertebral and cranial linearity (Figure 14). If the fluoroscopic examination is satisfactory, the laser marks are transferred to the patient's skin as future reference coordinates.

DISCUSSION

Reproduceable alignment could not be achieved on one obese female patient with the standard procedure of incorporating her arms into the negative impression. Subsequently the procedure was modified by putting her arms outside the impression, elbows flexed and hands resting near the area of her ears (Figures 13 and 14). This allowed construction of the side walls to contact her thoracic and pelvic areas, increasing control of her flesh and achieving satisfactory, reproduceable alignment.

CONCLUSION

Cranio/spinal positioning devices are not new to the radiological treatment of ependymomas. However, such devices are not used in all facilities. Given the difficulty of radiating such a large area while holding to precise parameters, it is suspected that the limitation of adequate construction technology precludes the use of

positioning devices in some radiation facilities. Additionally, by taking the negative impression on a simulator and using a laser alignment procedure, an improved alignment technique has been incorporated into the present molding procedure. Segmenting the mounting procedure from the molding sequence is unique, allowing for a desirably shorter patient casting time, while giving the orthotist the latitude to more precisely mount the negative mold.

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AUTHORS

Herbert G. Smith, C.P., owner of Herbert G. Smith Co. Inc., Smithtown, New York; Instructor of Neurological Surgery, State University of New York at Stony Brook, Stony Brook, New York; Appointed to Departments of Neurological Surgery, Orthopedic Surgery, and Radiation Oncology, State University Hospital at Stony Brook, Stony Brook, New York.

Stephanie L. Fertman, M.D., Clinical Director, Department of Radiation Oncology, State University of New York at Stony Brook, Stony Brook, New York.

Allen G. Meek, M.D., Chairman, Department of Radiation Oncology, State University of New York at Stony Brook, Stony Brook, New York.

David LaBelle, A.A.S., Chief Radiation Therapy Technologist, Department of Radiation Oncology, State University of New York at Stony Brook, Stony Brook, New York.

Orthotics and Prosthetics, Vol. 40, No. 2, pp. 58–60.

TECHNICAL NOTE:

An Easy-to-Fabricate Modified Hip Disarticulation Temporary Prosthesis

Michael S. Pinzur, M.D.
Richard M. Sakols, C.P.
Charles J. Lopez, Jr., Prosthetist
Phil Tirimacco, C.P.
Helen Macie Osterman, M.S., R.N.

INTRODUCTION

Severe peripheral vascular disease, malignant tumor, or trauma occasionally requires the performance of a very proximal lower limb amputation. When proximal amputation is performed in young people, it is expected that they will be able to ambulate with a prosthesis. Occasionally, however, the amputation surgeon is confronted with the older patient who requires amputation at the hip disarticulation or proximal femoral level. When amputation is performed at this level, the prosthetic fitting is similar to the hip disarticulation. Waters, et. al.[1] have shown high energy requirements associated with ambulation at these high levels of amputation. Standard techniques are available to start the prosthetic fitting process in the young patient,[2] but these techniques are expensive and time-consuming to the prosthetist. We have recently reported the results of a simple fabrication technique for early-post-surgical-prosthetic fitting of below-knee amputees.[3] The object of this paper is to present a simple system that can be used to fabricate a temporary prosthesis in this difficult patient population.

TECHNIQUE

When the surgical wound is healed or considered stable for weight-bearing, a "mini-spica" plaster cast is applied. Cotton stockinette, stitched closed on the amputated side, serves as the interface with a ¼" felt pad positioned around the waist and skived on all sides. The cast is made removable by splitting the contralateral suspensory limb and attaching two Velcro® closures (Figure 1). With the patient standing in parallel bars, a prefabricated plastic limb (STATLIMB, Kells Medical, Burr Ridge, Illinois) is attached with fiberglass casting tape. The plaster cast is reinforced with fiberglass casting tape to maintain strength and overall light weight. A rubber-soled shoe or cast-shoe is applied to the "foot" of the pre-fabricated limb, and immediate weight-bearing can be initiated (Figure 2).

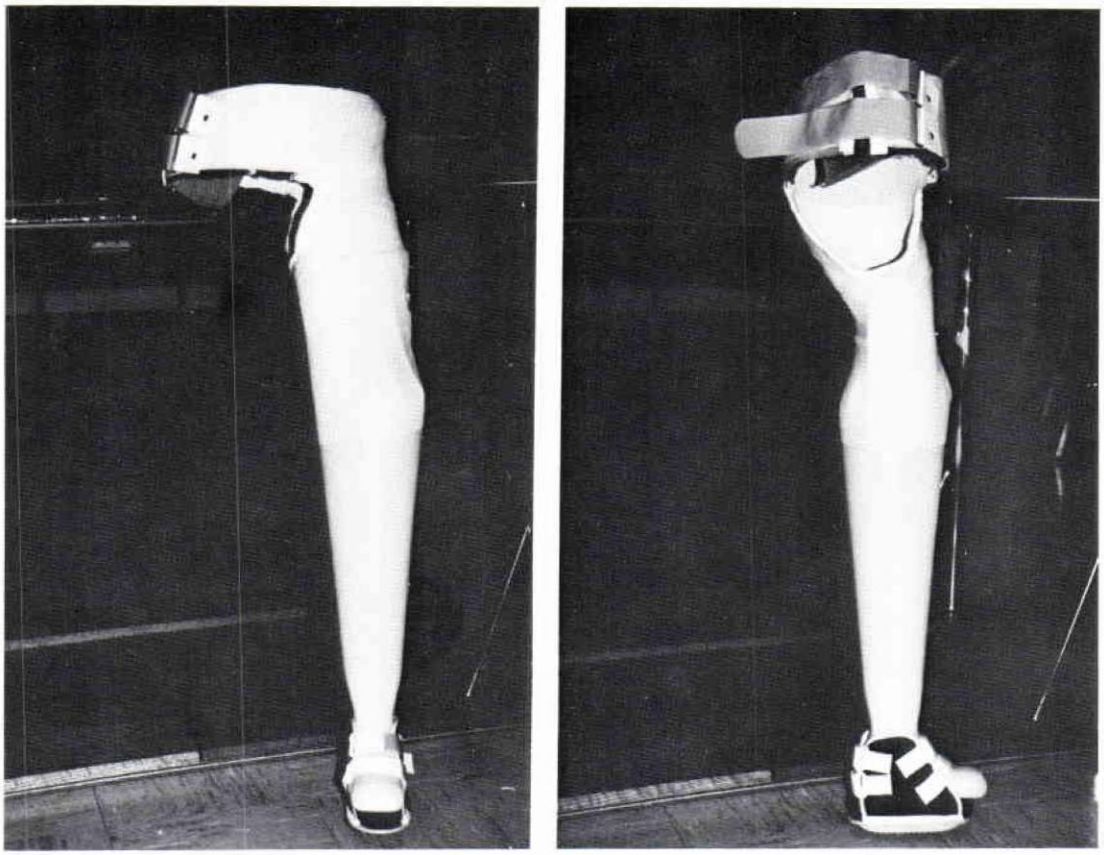

Figure 1. Front and side views of the Temporary Hip Disarticulation Prosthesis. The system uses a plaster "mini-spica" cast and a prefabricated plastic prosthesis attached with fiberglass cast-tape.

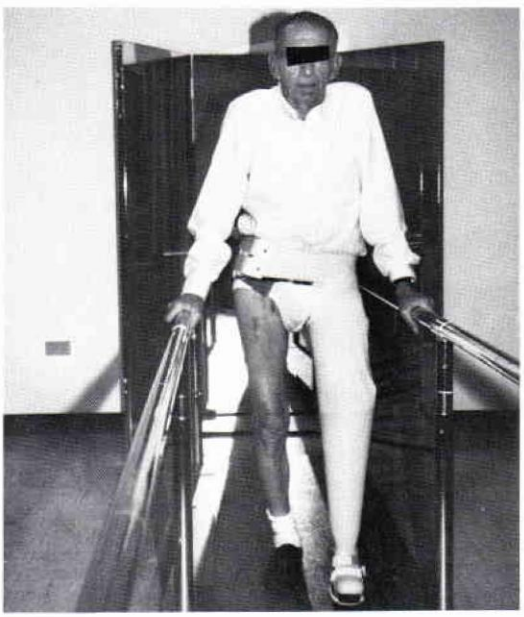

Figure 2. (right) A patient standing with the temporary prosthesis. He was able to start gait training and proved that he was capable of ambulation with a hip disarticulation-type prosthesis.

AUTHORS

The authors are from the Special Team for Amputation, Prosthetics/Orthotics (STAMP) Center, Hines Veterans Administration Medical Center and Loyola University Medical Center, Maywood, Illinois. Please address correspondence to: Michael S. Pinzur, M.D., Loyola University Medical Center, 2160 South First Avenue, Maywood, Illinois 60153.

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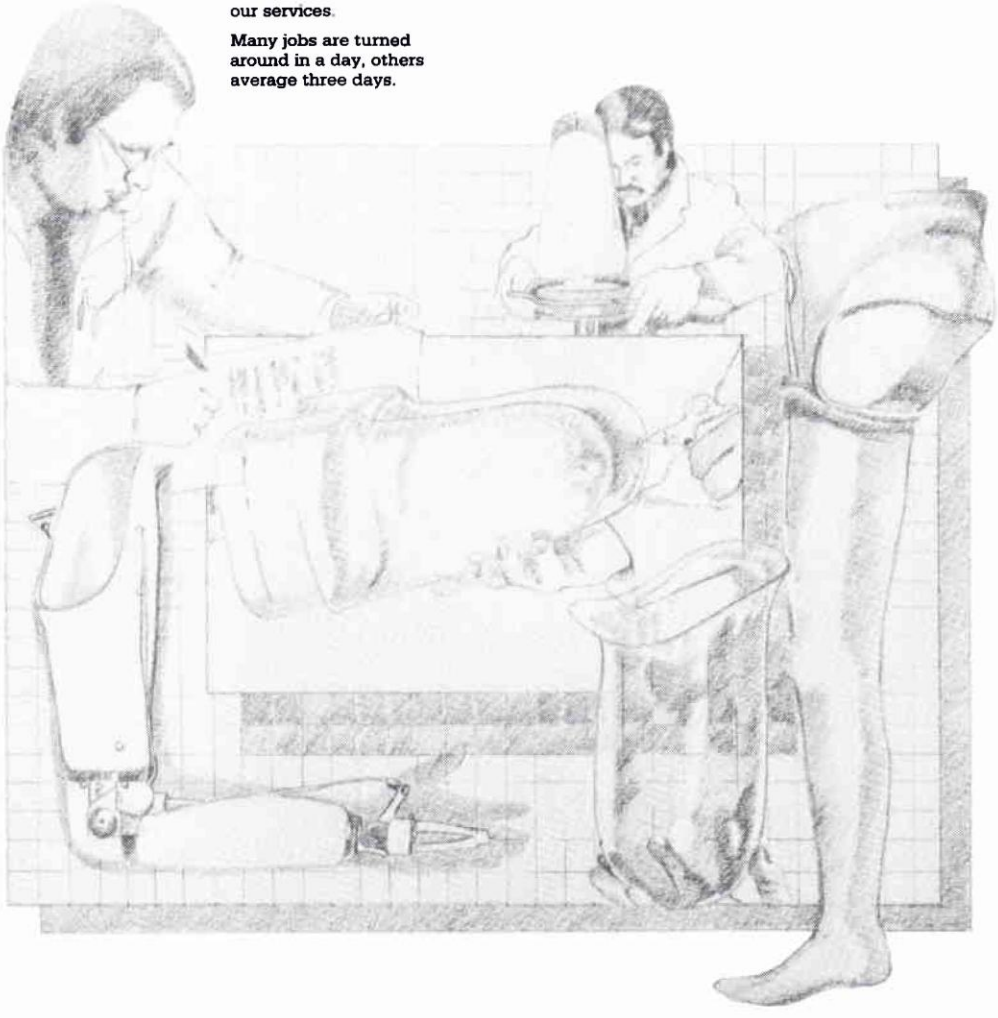

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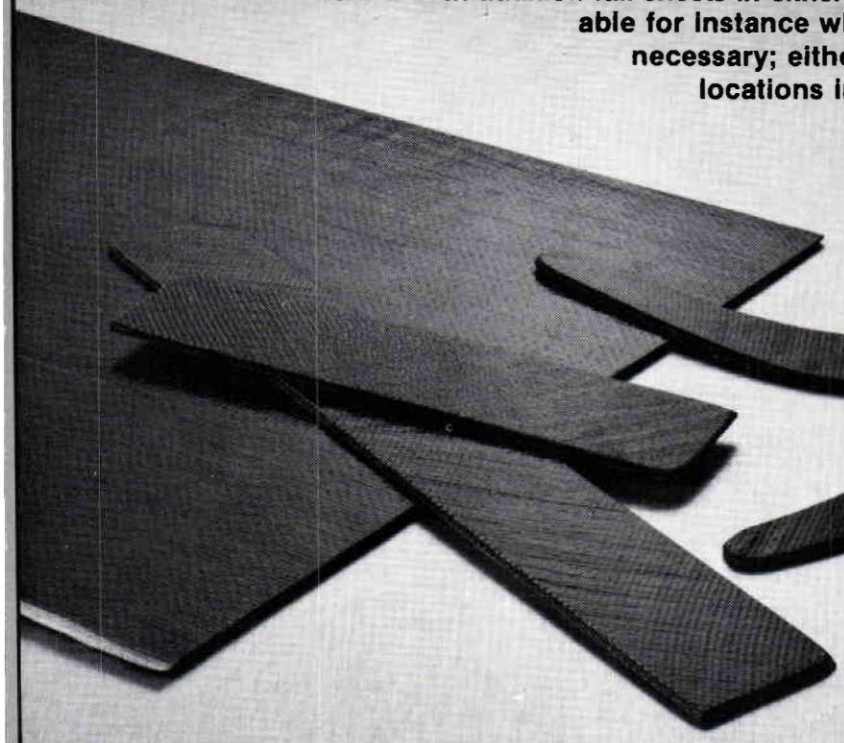

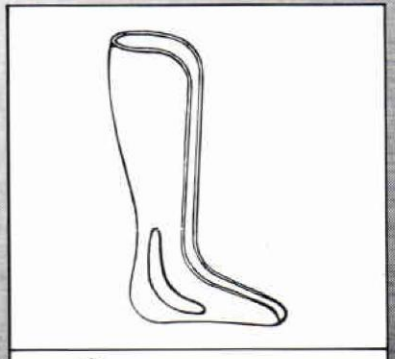

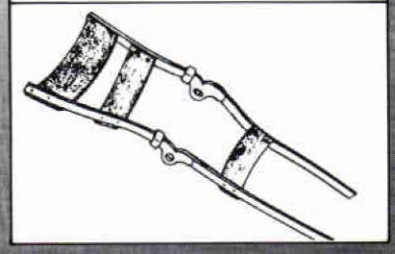

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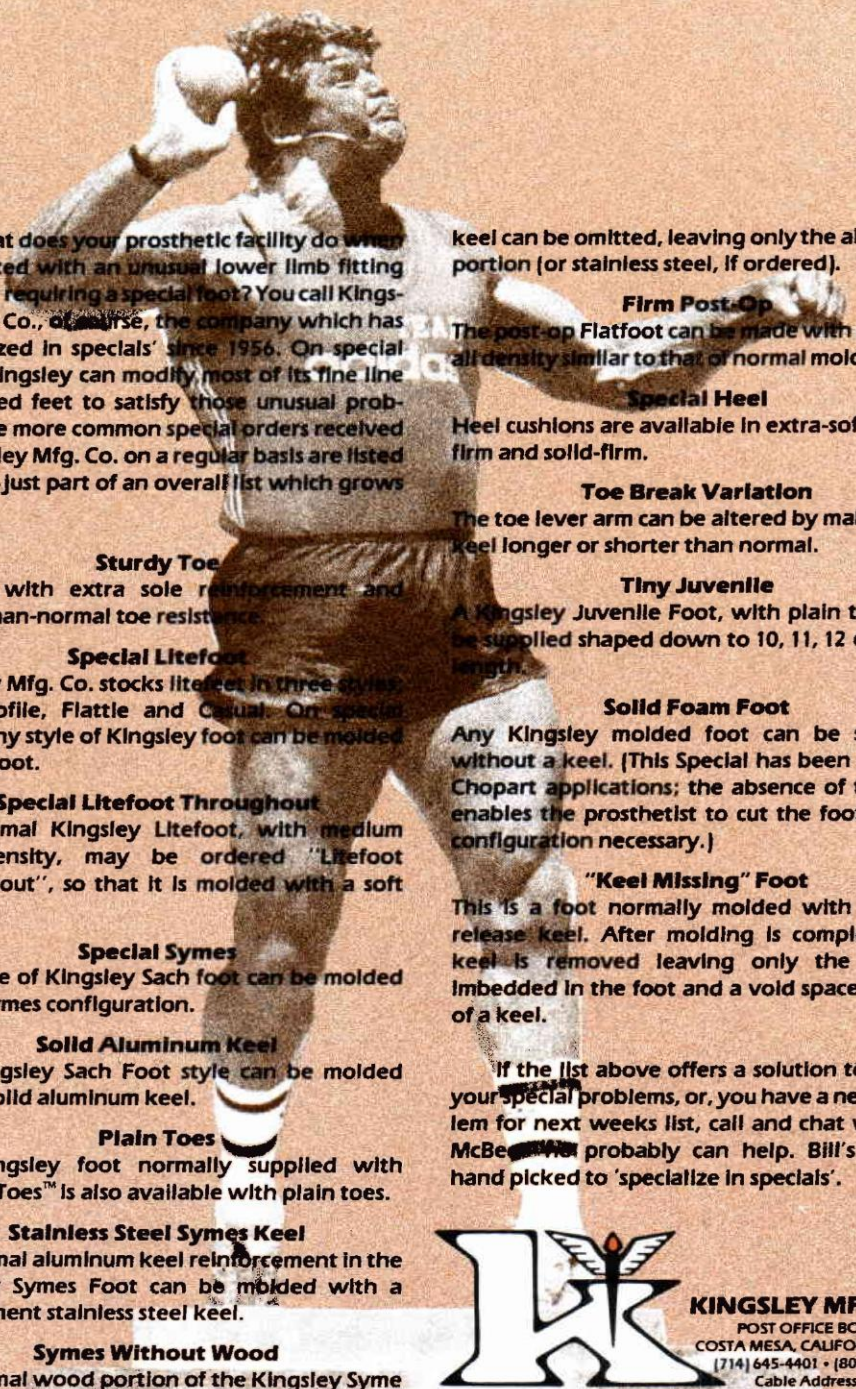

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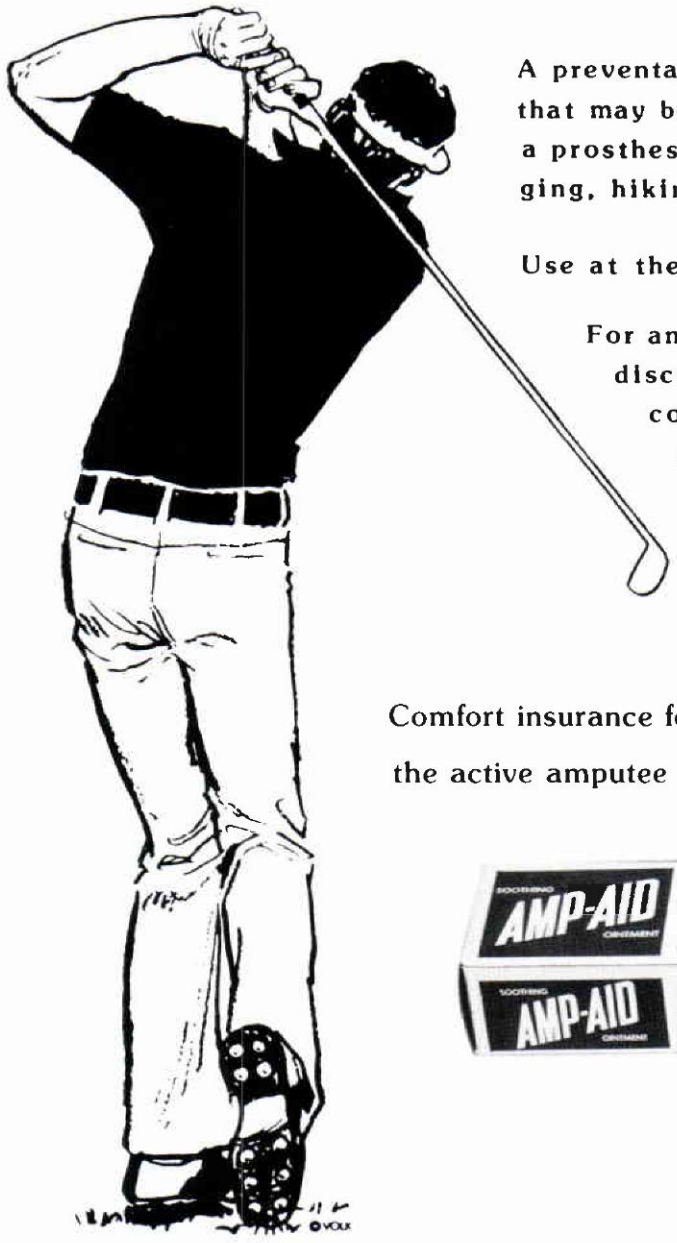

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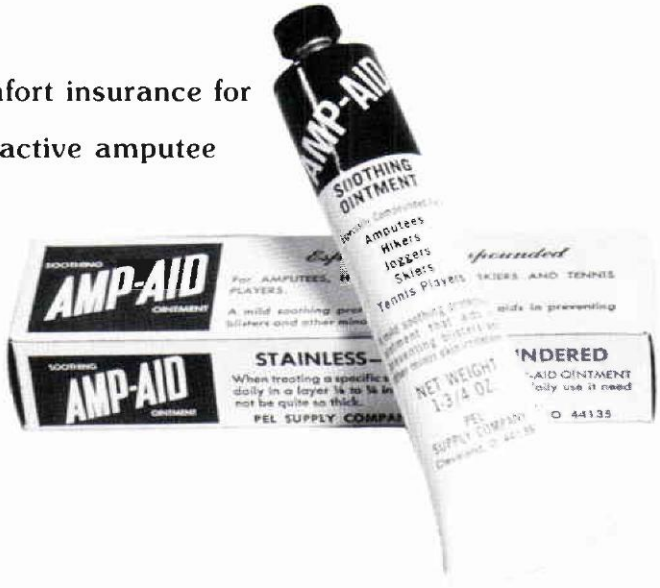

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BOOK REVIEWS

Charles H. Pritham, C.P.O.

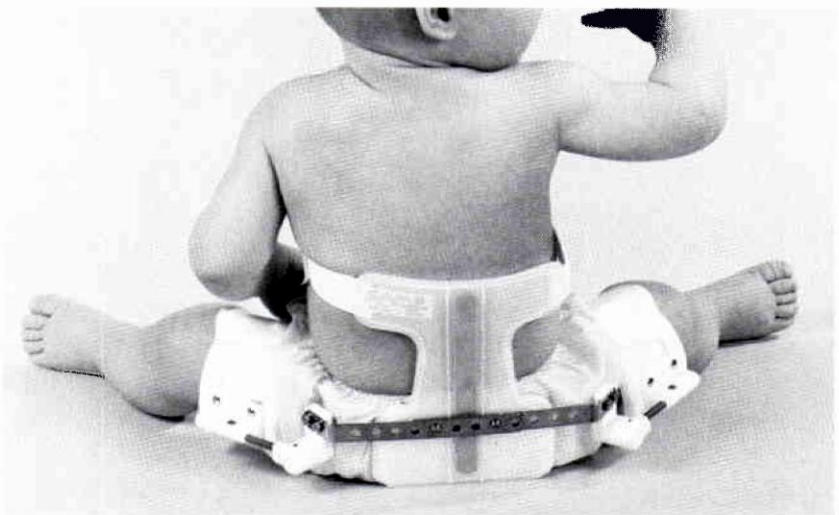
Physical Fitness: Sports and Recreation for Those With Lower Limb Amputation or Impairment, Bernice Kegel, R.P.T., VA Department of Medicine and Surgery, Rehabilitation R&D Service

This is the first of a series of "Clinical Supplements" that the VA proposes to publish about selected topics in rehabilitation. The goal is to present in some depth what is currently known about a given subject area, and what is of clinical relevance.

The current volume includes an exhaustive variety of material about a wide range of activities and modifications and devices to facilitate participation in such activities by those with lower limb amputations and similar involvement. It should be borne in mind that no attempt is made to offer suggestions for whom such activities might *not* be advisable. The purpose of the book, rather, is to suggest what the possibilities might be. It is perhaps best considered as a resource guide to be used in a discussion with the patient. It should also be borne in mind that some of the devices and adaptations are not commercially available and would have to be produced locally by the prosthetist, or are manufactured abroad and not sold by any distributor in the U.S.

New Products

New Product for Treatment of Hip Dysplasia



The Dynamic Hip Splint provides physicians and rehabilitation professionals with a method of controlled mobility for the treatment of congenital hip dysplasia.

The Dynamic Hip Splint utilizes the unique Dynamic Hinge, which permits active motion within desired limits. It is most effective in the initial treatment of the stable (nondislocated) hip that requires acetabular remodeling, or for the retention phase of treatment for hip dislocation, after stable reduction is achieved. The Dynamic Hip Splint provides a viable alternative to plaster casting.

The Dynamic Hip Splint is easy to handle and apply, thereby offering improved parent compliance. It does not restrict the parent's ability to interact with the baby and allows for easy bathing and diaper changing. Made of soft polyethylene with padded edges, the Dynamic Hip Splint is easy to clean and adjusts for patient growth (one size fits birth to nine months).

For additional information, contact Camp International, Inc., 109 W. Washington Street, Box 89, Jackson, Michigan 49201; 800-492-1088.

A Micro-Processor Controlled Stair-Climbing Wheelchair

The Mulag® Rollsteiger is a new kind of vehicle for the disabled, which allows more opportunities for independent mobility. One of its features is a stair-climbing mode, which allows the vehicle to successfully negotiate a gradient of up to 35°, according to the manufacturer's literature.

The chassis is constructed of a corrosive-resistant, structurally rigid, light alloy. Its wheels are made of vulcanized rubber, bonded to cast aluminum rims, and the traction belts are also made of vulcanized rubber, over steel bands. The Rollsteiger is 47 inches long, 27 inches wide, 43 inches high, and weighs 400 pounds.

The Rollsteiger Type I is powered by four 12 volt batteries, which drive a one horsepower engine. The batteries require recharging every 18 miles, or 3-5 hours of driving time. In its level surface mode, the Rollsteiger can reach speeds of up to four miles per hour. All functions, including steering, are contained in a single control panel, which may be mounted on either the right or left armrest. The Rollsteiger has three separate braking systems, designed for safety.

For more information, contact: Dory Corporation, 2522 S. Lima Street, Aurora, Colorado 80014; tel. (303) 695-1905.

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Rehabilitation of the amputee patient requires a team approach.
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Classified Ads

In order to properly calculate the number of words in (and the cost of) a classified advertisement according to the method used by AOPA, the advertiser should do the following. Add up every character in the ad, including commas, hyphens, etc. Divide the sum by five (we consider a word to consist of 5 characters) to find the total number of words. Then figure the cost based on these rates: MEMBERS—first 30 words $32.00. Each addiitonal word $1.50. NON-MEMBERS—first 30 words $78.00. Each additional word $4.00. Responses to AOPA Box numbers are forwarded unopened free of charge. Advertisements are to be paid in advance. Checks should be made payable to AOPA. Send to AOPA, 717 Pendleton Street, Alexandria, VA 22314. No classified ads will be taken by phone.

STAMP Prosthetist—Career position as an integral member of a multi-disciplinary amputation program utilizing immediate post-operative prosthetic management. Daily contact with leaders in the field of amputee patient care/research/education. Two fully equipped labs staffed by three certified professionals addressing a challenging and appreciative patient population. Our 340 bed acute care facility overlooks the beautiful San Francisco Bay Area, an exceptional cultural and recreational environment. This position provides excellent health care and vacation benefits. Interested individuals should submit a resume defining experience and education to: VA Medical Center, 4150 Clement Street (662/05), San Francisco, CA 94121; (415) 750-2107. *U.S. Citizenship required. EOE.*

CO or CPO: The University of Washington Baccalaureate Prosthetic-Orthotic Program is seeking an instructor. Duties also include patient care and clinic management. Send resume to:

Al Dralle, CPO
Rehab Medicine RJ-30
1959 NE Pacific Avenue
Seattle, WA 98195

PROSTHETIST

Certified or Board Eligible. Progressive office in Midwest city of 100,000. Opportunity to attend clinics and work in satellite office. Negotiable salary and additional benefits. All replies held in strict confidence. Interested applicants send resume to: AOPA Box 48603, 717 Pendleton Street, Alexandria, VA 22314.

CO or CPO or Board Eligible

Imemdiate opening for a dynamic individual interested in working at a new facility in Elmira, New York. Duties would include evaluating, fitting and fabricating orthotic and prosthetic devices. Interested applicants contact:

David R. Sickles, C.P.
Creative Orthotics & Prosthetics, Inc.
550 E. Church Street
Elmira, NY 14901

ORTHOTIST

Modern 150-bed health care, research and rehabilitation center located in Westchester County (25 miles from Manhattan) has immediate opening for Certified Orthotist. Experience desired. Must be talented in fabrication and committed to patient care. Outstanding career opportunity with dedicated staff and excellent compensation package. Send resume to: Personnel Department, **The Burke Rehabilitation Center, 785 Mamaroneck Avenue, White Plains, NY 10605.** Equal Opportunity Employer m/f.

The Burke Rehabilitation Center

The Hospital For Special Surgery

Outstanding opportunities are available at our major NYC orthopedic voluntary teaching hospital, the orthopedic and rheumatic disease service of the New York Hospital-Cornell Medical Center. We are conveniently located on the East Side of Manhattan. The professionals we are seeking must enjoy the challenge of diversity. Our patient population includes extensive pediatric and geriatric prosthetics as well as sports medicine and operating room patients.

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Career growth opportunity for professional with BS degree, certification in Prosthetics and Orthotics, plus 5 years' experience. This leadership position requires a demonstrated record of supervisory and management abilities.

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To qualify, the successful candidate must have a BS degree, certification, 5 years' experience in all areas of prosthetics, including managerial skills.

We offer a highly professional atmosphere, medical inservice training, a fully equipped hospital on-site technical area, excellent salary commensurate with experience and comprehensive benefits program including tuition reimbursement.

Interested candidates should call **Ann White, Employment Manager at (212) 606-1118** or send resume to the **Personnel Department.**

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Orthotist, Certified or Board Eligible—Good salary and benefits, permanent position, requires some experience in bracing scoliosis and post operative spinal fusion. Contact: Isidore Zamosky, Inc., 608 S. Main Street, Spring Valley, NY 10977; (914) 352-2148 or 352-2397.

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Well established 14 year old Orthotic facility in northern Arizona mountains. Large territory offers excellent opportunity for the right person.

Medical Engineering
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(602) 779-0220

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Immediate opening available. Salary commensurate with experience. Benefits include full health plan for employee. Profit sharing available.

Dorsch Prosthetics and Orthotics
109 East 29th Street
New York, NY 10016
(212) 683-2485

Contact: Mrs. Marita Dorsch Carozza

Established Orthotic Facility for Sale. National Capital location offers excellent opportunities for right person(s) or Co. Reply to: Progressive Orthopaedics P/L, Unit 6 Bowman Street, Macquarie A.C.T. 2614 AUSTRALIA; (062) 516-695.

CP or CO

Certified or Board Eligible. Immediate position open in progressive, established office in the Midwest. Duties include patient management of all ages in office, hospital, and clinic settings. Technical staff management may be required. Excellent opportunity for the right person. Attractive salary; liberal fringe benefits. Serious individuals only. Send resume to: ALO of Urbana, Inc., 806 W. University Avenue, Urbana, IL 61801.

Orthotics - Prosthetics Division Director

The University of Michigan Medical Center

The University of Michigan Medical Center is seeking candidates for the newly created position of Division Director of Orthotics and Prosthetics. Candidates should desire to make a major contribution to the profession in an academic center. Orthotics and Prosthetics is a division of the Department of Physical Medicine and Rehabilitation, an academic department of the University of Michigan Medical School. The Division is located in the new University Hospital.

The responsibilities of the Director include the administration and supervision of a full range of clinical services, research and educational activities. Candidates must possess a C.P.O. (or C.O./C.P. with equivalent experience) with a minimum of 4-5 years of professional experience including progressive supervisory and management responsibilities. An advanced degree is desirable.

Inquiries or resumes may be sent to: **Sarah Albritton, Employment Representative, The University of Michigan Medical Center, Department of Human Resources, NI8A05 300 N. Ingalls, Box 0418, Ann Arbor, MI 48109.**

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We are seeking a suitably qualified orthotist to manage a dept. of 18. The candidate must possess a comprehensive knowledge of orthotics and have skills to communicate effectively. Responsibilities include recruitment of staff, delegation of duties, supervision of students and routine management procedures. Reply to the Personnel Manager by 1/9/1986 with resume and references. Direct enquiries to Mr. P. Williams, Chief of Surgery.

CERTIFIED PROSTHETIST ORTHOTIST: Needed with clinical and fabrication experience. Competitive salary and benefits. Send resume and salary requirements. All replies considered confidential.

Texoma Health Care Center
120 S. Crockett
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Immediate opening for experienced CPO for modern facility to manage or for possible partnership. Reply to Pete Allen, Birmingham Limb & Brace Co., 3020 4th Avenue South, Birmingham, AL 35233.

SEEKING C.P. OR BOARD ELIGIBLE to fit, fabricate, attend clinics, and patient management. Send resume to: Advanced Orthopedic Lab Inc., 22100 Coolidge, Suite 6, Oak Park, MI 48237.

CERTIFIED ORTHOTIST—The University of Kansas Medical Center has a position available immediately for Certified Orthotist. Position offers/requires participation in a variety of specialty clinics: Muscular Dystrophy, Spina Bifida, Cerebral Palsy, as well as treating patients requiring a broad spectrum of orthoses. Position also offers excellent working professional relationship with physicians and other allied health team members, a neat and clean working environment and excellent fringe benefits. Send resume to: Paul Trautman, CPO, University of Kansas Medical Center, 39th & Rainbow Boulevard, Kansas City, KS 66103; (913) 588-6548. *An Equal Opportunity Affirmative Action Employer.*

Director of Orthotics

The **University of Wisconsin Hospital and Clinics,** an internationally recognized, major medical center located in Madison, Wisconsin, is seeking a Certified Orthotist as Director for its Orthotics Department.

We offer a highly professional atmosphere, excellent salary commensurate with experience, a comprehensive benefit program, and a fully equipped laboratory. The position offers opportunities for clinical practice, management, program development, and teaching.

The Director will be responsible for providing overall leadership and management to a well-established and recognized Orthotics department. Specific activities include management of patients, staff training and supervision, program management and development, and teaching.

Candidate should have a Baccalaureate degree and certification in Orthotics with additional experience and interest in Prosthetics desirable. A minimum of 2-3 years of clinical and management experience required with additional background in training and marketing preferred. Submit resume to:

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Administrator, Rehabilitation Center
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A desire to improve the quality of life enjoyed by amputees, combined with a recognition of the limitations imposed by conventional prosthetic feet, brought a team of aerospace engineers, prosthetists, industrial designers and physicians together in Seattle. The result? THE SEATTLE FOOT™. Quite literally a giant step forward for lower extremity amputees.

THE SEATTLE FOOT™ has the features that amputees and prosthetists deserve.

Dynamic... a Dupont Delrin™ keel stores and releases energy with each step to supply natural lift and thrust.

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THE SEATTLE FOOT™ has been enthusiastically accepted by a wide majority of amputees who evaluated it. One of these individuals is Jim Clark, a University of Washington professor.

"THE SEATTLE FOOT™ has vastly improved my options as an amputee. When I had a standard SACH foot I became tired and sore after walking for more than half an hour. With the natural absorption and spring of THE SEATTLE FOOT™ I can now comfortably walk and jog for much longer. I recently even spent time in the Swiss Alps hiking up to ten miles a day."

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BUSINESS SURVIVAL

September 6, 1986
9:00 a.m.–5:00 p.m.

Holiday Inn Crowne Plaza
Los Angeles,
CALIFORNIA

BPDC encore presentation

By popular demand, this will be the fourth presentation of the one-day "Business Survival" seminar presented by the AOPA Business Procedures and Data Committee (BPDC).

Member response from the previous "Survival" seminars was extremely positive as shown by the comments below:

"Some of the information gained can be implemented immediately"
"Presentations on diversification and cost containment were excellent"
"Good ideas on videos, billing, and communication with patients"

The seminar will be led by Don Hardin of the BPDC. Speakers include John Ficociello, CPO, Jack Gold, CPO, and Robert Manfredi, Sr., CPO.

Topics will include:

- State Organizations
- Video Education
- Counselling
- Combatting Competitive Influences
- Cost Containment
- Selling Custom vs. Prefab
- Loyalty
- Multiple Locations
- Public Relations
- Transportation
- Resident Indoctrination
- Diversification
- Investing Wisely

Hotel Reservations: reservations must be made not later than *August 22, 1986,* by calling the hotel directly. Guaranteed rates for meeting participants are $65.00 for a single room. Double rooms are also available. The Crowne Plaza is located in close proximity to the Los Angeles International Airport.

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5985 Century Boulevard
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(213) 642-7500

Seminar Reservation Form

"AOPA BPDC Survival Seminar"

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_____ $ 95.00 Registration Fee for AOPA Members—includes lunch
_____ $150.00 Registration Fee for Non-AOPA Members—includes lunch

Make Check Payable to: American Orthotic and Prosthetic Association

Mail to: AOPA
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Alexandria, Virginia 22314

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